

CLOSURE AND  
POST CLOSURE CARE PLAN  
FOR  
WASTE UNITS 1, 2, 3, 5, 7, 9, 10, 11, 12, 13, 16, AND 17  
PROTECCION TECNICA ECOLOGICA, INC.

Submitted to:

Proteccion Tecnica Ecologica, Inc.  
Carr. 385 KM 3.5  
Penuelas, PR 00624

Submitted by:

OHM Remediation Services Corp.  
5335 Triangle Parkway, Suite 450  
Norcross, GA 30092

September 1996

Project No. 16139

# TABLE OF CONTENTS

---

## LIST OF ACRONYMS

1.0	INTRODUCTION .....	1-1
1.1	Site Description .....	1-1
1.2	Maximum Waste Inventory .....	1-2
1.2.1	Waste Unit 1 .....	1-3
1.2.2	Waste Unit 2 .....	1-3
1.2.3	Waste Unit 3 .....	1-3
1.2.4	Waste Unit 4 .....	1-3
1.2.5	Waste Unit 5 .....	1-4
1.2.6	Waste Unit 7 .....	1-4
1.2.7	Waste Unit 9 .....	1-4
1.2.8	Waste Unit 10 .....	1-4
1.2.9	Waste Unit 11 .....	1-4
1.2.10	Waste Unit 12 .....	1-4
1.2.11	Waste Unit 13 .....	1-5
1.2.12	Waste Unit 15 .....	1-5
1.2.13	Waste Unit 16 .....	1-5
1.2.14	Waste Unit 17 .....	1-5
2.0	CLOSURE .....	2-1
2.1	Closure Performance Standards .....	2-1
2.2	Specifications and Plans .....	2-1
2.3	Schedule of Closure .....	2-3
3.0	CLOSURE COVER DESIGN .....	3-1
3.1	Closure Cover Foundation .....	3-1
3.1.1	Settlement Potential .....	3-1
3.1.2	Bearing Capacity and Stability .....	3-2
3.2	Closure Cover System .....	3-2
3.3	Geomembrane Liner .....	3-3
3.3.1	Materials Specification .....	3-3
3.3.2	Physical Stresses .....	3-4
3.3.3	Differential Settlement in the Sub-base .....	3-4
3.3.4	Strain Requirements at the Anchor Trench .....	3-5
3.3.5	Strain Requirements Over Long Side Slopes .....	3-5
3.3.6	Chemical Compatibility .....	3-5
3.3.7	Liner Strength Requirements and Integrity Under Mechanical Stresses .....	3-5
3.3.8	Friction Factor .....	3-6
3.3.9	Best Anchorage Configuration for the Geomembrane .....	3-6
3.3.10	Cover Layer Stability on Top of Geomembrane .....	3-7
3.3.11	Installation .....	3-7
3.4	Coverage .....	3-8
4.0	LEACHATE, SUBSURFACE, AND SURFACE WATER .....	4-1
4.1	Leachate Monitoring System .....	4-1
4.2	Drainage Layer Design .....	4-1
4.3	Run-on Control .....	4-2
4.4	Run-off Control .....	4-2

## TABLE OF CONTENTS - CONTINUED

5.0	<b>GAS MANAGEMENT SYSTEM</b> .....	5-1
5.1	Gas Production and Migration .....	5-1
5.2	Passive Gas Vents .....	5-2
6.0	<b>CONSTRUCTION QUALITY ASSURANCE PLAN</b> .....	6-1
6.1	Responsibility and Authority .....	6-1
6.2	Meetings and Reports .....	6-2
6.3	Personnel Qualifications .....	6-2
6.4	Inspections Activities .....	6-3
6.4.1	Sub-Base Layer .....	6-3
6.4.2	Gas Management System .....	6-3
6.4.3	Low Permeability Layer .....	6-4
6.4.4	Geomembrane .....	6-4
6.4.5	Geotextile .....	6-5
6.4.6	Cover Layer .....	6-5
7.0	<b>POST CLOSURE ACTIVITIES</b> .....	7-1
7.1	Post Contract Contact .....	7-1
7.2	Post Closure Standards .....	7-1
7.3	Survey Plat .....	7-2
7.4	Security Controls .....	7-2
7.5	Inspection, Monitoring and Maintenance .....	7-3
7.5.1	Certification of Closure .....	7-3
7.5.2	Inspections .....	7-3
7.5.3	Security Control Devices .....	7-4
7.5.4	Erosion Damage and Cover Settlement, Subsidence, and Displacement .....	7-4
7.5.5	Integrity of Run-on and Run-off Control Measures .....	7-5
7.5.6	Gas Venting System .....	7-5
7.5.7	Benchmarks .....	7-5
7.6	Post Closure Notices .....	7-5
7.7	Post Closure Uses .....	7-6
7.8	Training .....	7-6
8.0	<b>CLOSURE AND POST CLOSURE COST ESTIMATE</b> .....	8-1
9.0	<b>REFERENCES CITED</b> .....	9-1
<b>TABLES</b>		
Table 2.1	Schedule of Closure Activities	
Table 3.1	Friction Values and Efficiencies for Various Clay Soils to Various Geomembranes	
Table 7.1	Sample Inspection Log	
<b>APPENDICES</b>		
Appendix A	Corrective Action Management Unit (CAMU) Proposal for Waste Units 4, 7, and 9	
Appendix B	Sampling and Analysis Plan for CAMU Waste Units 4, 7, 9, and 15	

## 1.0 INTRODUCTION

---

Proteccion Tecnica Ecologica, Inc. (Proteco) owns and operates a waste disposal facility in Penuelas, Puerto Rico and is permanently closing Waste Units 1, 2, 3, 5, 7, 10, 11, 12, 13, 16, and 17. This document describes the Closure and Post Closure Plan for those waste units. It incorporates US EPA Region II comments from correspondence. Preparation of this plan is directed by the United States Environmental Protection Agency (USEPA) and has been developed in accordance with 40 Code of Federal Regulations (CFR) 264 and the Commonwealth of Puerto Rico's Regulation for the Control of Hazardous and Nonhazardous Solid Wastes, Rule 816.

Also incorporated by reference into this Closure and Post Closure Plan is the revised CAMU proposal provided in Appendix \_\_\_\_ of this submittal. This proposal describes the permanent Closure of three additional Waste Units 4, 7, and 15. Waste from these units will be excavated, treated on-site, and consolidated into Waste Unit 9. The CAMU proposal was submitted to the US EPA for review and comment in January, 1996. Proteco received conditional approval of the plan in July, 1996 from US EPA pending the public notice and comment requirements. This document incorporates US EPA comments for inclusion as part of the final closure plan package.

### 1.1 SITE DESCRIPTION

Proteco's facility is located on the southern side of Puerto Rico approximately 2.5 miles southeast of Penuelas, 2 miles north of Tallaboa Bay of the Caribbean Sea, and 1.5 miles east of the Lower Tallaboa River Valley. The closest community which is approximately 1.5 miles away is Sebouruco. The site occupies approximately 35 acres and is situated in a small valley ranging in elevation from approximately 260 ft msl to 400 feet msl. The rugged upland terrain of the valley is steep and supports little vegetation. The steep hills which surround the site are covered year round with xerophilous vegetation and are inhospitable to residential, commercial, or agricultural development.

Typical climatic conditions are semiarid with 43 inches of annual precipitation, 88 inches of annual evaporation, 79 degrees Fahrenheit annual average temperature, and predominantly easterly winds off the Caribbean Sea. Most precipitation is lost to run-off due to the hard, impermeable surface soil conditions and steep slopes.

The geology beneath the Proteco facility consists of brown/yellow silty clay from land surface with depths ranging from 25 to 115 feet below land surface; gray silty clay occurs beneath the yellow silty clay and is 90 to 130 feet thick; limestone underlies the gray silty clay and is approximately 60 feet thick.

There are three water-bearing zones beneath the site; 1) Alluvial deposits, 2) Principal water-bearing zone, and 3) Reef limestone. There is little evidence to support the idea that the alluvial deposits are prevalent across the Proteco facility. The occurrence of the alluvial deposits is best classified as sporadic with limited extent. The water-bearing strata that is consistently present both vertically and horizontally beneath the Proteco facility is that of the principal water-bearing zone and the Reef limestone.

The Principal water-bearing zone is present in brown/yellow silty clay and gray silty clay lithologic sequences. Depth to groundwater in the Principal water-bearing zone is estimated to be within 50 feet of land surface.

Under optimum natural conditions, the Principal water-bearing zone contains saline water that is non-potable and unsuitable for livestock or irrigation purposes. In addition, the low permeability of the Principal water-bearing zone is insufficient to yield an appreciable amount of water for any purpose.

The Reef limestone water-bearing zone occurs beneath the gray silty clay sequence and the associated Principal water-bearing zone. Depth to groundwater in the Reef limestone water-bearing zone is estimated to be 100 to 200 feet below land surface. The Reef limestone water-bearing zone is less saline than the Principal water-bearing zone and may be acceptable for salt-tolerant livestock and irrigation.

A vicinity map of the area surrounding the site and topographic map of the facility is included in the Project Drawings.

## 1.2 MAXIMUM WASTE INVENTORY

Various waste disposal activities were conducted at the Proteco disposal facility and in different areas of the site. There are fifteen waste units total at the site addressed by this Closure and Post Closure Plan. Twelve waste units will be closed in place with a geosynthetic and soil closure cover as described in subsequent sections. They are listed below with the activity that was performed at each unit.

- |                 |                         |
|-----------------|-------------------------|
| • Waste Unit 1  | Drum burial             |
| • Waste Unit 2  | Drum burial             |
| • Waste Unit 3  | Drum burial             |
| • Waste Unit 5  | Drum burial             |
| • Waste Unit 10 | Immobilization facility |
| • Waste Unit 11 | Immobilization facility |
| • Waste Unit 12 | Land treatment area     |

- Waste Unit 13              Rainwater lagoon
- Waste Unit 16              Immobilization facility
- Waste Unit 17              Neutralization impoundment

Four additional Waste units will be closed alternately as addressed in the CAMU proposal provided as an attachment to this closure plan package. Wastes from units 4, 7, and 9 will be excavated, heated on-site with a chemical fixation process and consolidated within a lined closure cell constructed at waste unit 9. Waste unit 15 is also included but does not involve excavation or treatment of material. These units and activities performed at each unit are as follows:

- Waste Unit 4              Drum Storage facility
- Waste Unit 7              Neutralization impoundment
- Waste Unit 9              Oil Lagoon
- Waste Unit 15             Aboveground storage facility

#### **1.2.1 Waste Unit 1**

Waste Unit 1 is one of four drum burial pits that is being closed in this action and contains various waste streams. There are approximately 5,800 drums believed to contain approximately 317,000 US gallons of the United States Environmental Protection Agency (USEPA) Waste Code designations D-001, D-002, D-008, D-009, D-054, F-001, F-003, F-005, F-006, K-046, P-012, U-002, U-044, U-108, U-112, U-113, U-117, U-122, U-134, U-144, U-154, U-162, U-188, U-210, U-211, U-220, U-225, and U-226.

#### **1.2.2 Waste Unit 2**

Waste Unit 2 was used to bury drums containing various waste streams. There are approximately 450 drums believed to contain approximately 22,900 US gallons of waste having the same waste codes as listed above.

#### **1.2.3 Waste Unit 3**

Waste Unit 3 was used to bury drums containing various waste streams. There are approximately 1700 drums believed to contain approximately 92,600 US gallons of waste having the same waste codes as listed above.

#### **1.2.4 Waste Unit 4**

Waste Unit 4 was an above ground storage facility. Approximately 1,000 drums containing contaminated waste were removed in 1992. Shallow soil contamination exists below the former drum storage facility, with soils containing total chromium and lead. It is estimated that 1,500 cubic yards of soil are impacted. This waste unit will be closed as part of the CAMU.

#### **1.2.5 Waste Unit 5**

Waste Unit 5 was used to bury drums containing various waste streams. The quantity of drums, the volume of waste, and the waste code designations for the material contained in the burial pit is unknown at this time.

#### **1.2.6 Waste Unit 7**

Waste Unit 7 was used as a neutralization impoundment. Records indicate that the pit received characteristic corrosive wastes and no listed wastes. The latest sampling activities at the site indicate that the contents of the unit do not exhibit the characteristic of corrosivity. It is estimated that 2,700 cubic yards of waste will be removed, treated, and closed as part of the CAMU.

#### **1.2.7 Waste Unit 9**

Waste Unit 9 was an oil lagoon used to collect waste oil. The waste believed to be contained in the unit was approximately 477,700 gallons of water and approximately 300,000 gallons of sludge. During the fall of 1994, soil was added and mixed with the liquid in the lagoon to produce a solid matrix. The substance was then covered with clean soil to the grades of the surrounding area. The primary waste is believed to be waste code designation D-001, but D-002, D-005, D-007, D-008, D-009, D-010, D-013, D-106, D-108, F-001, F-002, F-154, F-188, F-196, F-210, F-220, F-226, F-230, and F-239 are may also be present. It is estimated that 5,300 cubic yards of waste will be treated and closed as part of the CAMU cell.

#### **1.2.8 Waste Unit 10**

Waste Unit 10 is one of three immobilization facilities which is believed to contain approximately 950 cubic yards of waste. The constituents are not known.

#### **1.2.9 Waste Unit 11**

Waste Unit 11 is the second of three immobilization facilities that is being closed at the site. The unit is believed to contain approximately 5,800 cubic yards of waste consisting of the following waste code designations; D-001, D-002, D-008, D-009, D-013, F-002, F-009, U-044, U-138, U-140, U-144, U-154, U-156, U-188, U-201, U-210, U-226, and U-239.

#### **1.2.10 Waste Unit 12**

Waste Unit 12 was used as a land treatment area and contains approximately 17,800 cubic yards of waste that is designated with the waste codes of D-002, D-013, and F-003.

#### **1.2.11 Waste Unit 13**

Waste Unit 13 was used as a rainwater collection lagoon for the site. Information on constituents contained in the rainwater are unknown. The volume of water varies during the year due to the volume of run-off and the rate of evaporation from 0 up to approximately 80,000 gallons.

#### **1.2.12 Waste Unit 15**

Waste Unit 15 consists of an above ground storage tank which formerly contained shampoo contaminated with Lindane. This 5,000 gallon capacity tank containing 1-2 inches of solid residue will be cleaned, cut up and disposed as scrap metal. No wastes will be excavated or treated from this unit and/or placed within the CAMU cell.

#### **1.2.13 Waste Unit 16**

Waste Unit 16 is the last of the three immobilization facilities that will be closed at the site. It contains approximately 29,700 cubic yards of waste. The waste codes believed to be represented within the unit are D-001, D-002, D-007, D-008, D-009, D-013, F-001, F-002, F-003, F-005, F-006, F-007, F-018, K-050, K-051, K-052, P-030, P-098, U-002, U-019, U-044, U-151, U-154, U-159, U-188, U-196, U-210, U-220, U-223, and U-226.

#### **1.2.14 Waste Unit 17**

Waste Unit 17 was used as a neutralization impoundment and is believed to contain 30,200 gallons of waste designation D-002 with small quantities of D-001 and D-003.

## 2.0 CLOSURE

---

### 2.1 CLOSURE PERFORMANCE STANDARDS

The waste units will be closed with the construction of a geosynthetic and soil closure cover system in compliance with the USEPA guidance documents. At final closure, Proteco will close the waste units in a manner that:

- Minimizes the need for further maintenance, and
- Controls, minimizes, or eliminates, to the extent necessary, to prevent (1) threats to human health and the environment, (2) post closure escape of hazardous waste, (3) hazardous waste constituents, leachate, (4) contaminated rainfall, and (5) migration of waste decomposition products to the ground water, surface water, or to the atmosphere.

This final closure cover system is a Resource Conservation and Recovery Act (RCRA) closure cover that minimizes threats to human health and the environment by physically separating buried wastes or contaminated materials from humans, animals, and plant roots. The closure cover reduces the leaching of contaminants from buried wastes or contaminated soil by reducing water infiltration, thus lessening the risk of groundwater and surface water contamination. The cover design promotes surface drainage and run-off and channels gas emissions. By establishing groundwater monitoring wells, gas vents, and erosion control measures this closure cover effectively reduces the need for continuing maintenance.

### 2.2 SPECIFICATIONS AND PLANS

To perform the work that is described in this Closure and Post Closure Plan other ancillary documents were prepared that describe and depict different aspects of the closure process. The construction specifications for this Closure and Post Closure Plan are provided in the document, "*Construction Specifications for the Proteccion Tecnica Ecologica, Inc. Closure of Waste Units 1, 2, 3, 5, 9, 10, 11, 12, 13, 16, and 17*" dated November, 1995 and as amended in this submittal. A construction quality assurance plan for the geosynthetic and soil components of the closure cover entitled "*Construction Quality Assurance Plan for the Proteccion Tecnica Ecologica, Inc. Closure of Waste Units 1, 2, 3, 5, 9, 10, 11, 12, 13, 16, and 17*" dated November 1995 (also as amended in this submittal) provides methods for ensuring that the work is constructed and documented in accord with the Construction Specifications. Plans that depict the work to be performed are provided in the document, "*Construction Drawings for the Proteccion Tecnica Ecologica, Inc Closure of Waste Units 1, 2, 3, 5, 9, 10, 11, 12, 13, 16, and*

17" dated November 1995. Other documents that were prepared for the execution of the closure are an Erosion Control Plan and a Spill Prevention, Countermeasure, and Control Plan. All documents were prepared by OHM Remediation Services Corp. In the case of conflicting information between the Construction Specifications, the CQA Plan, the Construction Drawings, and the Closure Plan, the Construction Specifications will take precedence.

The Construction Specifications include the following sections:

#### SECTION TITLE

00200	Instructions to Bidders
00300	Proposal
00410	Bid Bond
00500	Contract
00610	Performance Bond
00620	Payment Bond
00650	Certificate of Insurance
00700	General Conditions
01000	Special Conditions
01010	Summary of the Work
01085	Applicable Standards
01300	Submittals and Substitutions
01310	Construction Schedule
02110	Site Preparation
02210	Grading
02220	Sub-Base Preparation
02221	Low Permeability Layer
02223	Cover Layer
02224	Trenching and Backfilling for Gas Vent Systems
02225	Surface Armor Layer
02270	Rock Excavation
02271	Riprap
02272	Erosion and Sediment Control
02281	Geomembrane
02282	Geotextile
02670	Monitoring Well Installation
02730	High Density Polyethylene (HDPE) Pipe
02930	Seeding, Sodding, and Mulching

The following sheets constitute the Project Drawings:

#### SHEET TITLE

1	Cover Sheet
2	Vicinity Map, Site Location Map, Legend, and Notes
3	Overall Site Plan and Existing Topography
4	Existing Topography, Units 1, 2, 3, & 5

5	Existing Topography, Units 9, 10, 11, 12, 13, 16, & 17
6	Overall Sub-Base Grading Plan
7	Sub-Base Grading Plan, Units 1, 2, 3, & 5
8	Sub-Base Grading Plan, Units 9, 10, 11, 12, 13, 16, & 17
9	Overall Final Grading and Site Plan
10	Final Grading Plan, Units 1, 2, 3, & 5
11	Final Grading Plan, Units 9, 10, 11, 12, 13, 16, & 17
12	Sediment Basin
13	Drainage Plan
14	Erosion/Siltation Control Plan, Units 1, 2, 3, & 5
15	Erosion/Siltation Control Plan, Units 9, 10, 11, 12, 13, 16, & 17
16	Cross-Section Cutting Planes, Units 1, 2, 3, & 5
17	Cross-Section Cutting Planes, Units 9, 10, 11, 12, 13, 16, & 17
18	Sub-Base Cross-Sections, Units 1, 2, 3, & 5
	Cross-Sections A-A', B-B', C-C', D-D', E-E', and F-F'
19	Sub-Base Cross-Sections, Units 9, 10, 11, 12, 13, 16, & 17
	Cross-Sections G-G' and H-H'
20	Sub-Base Cross-Sections, Units 9, 10, 11, 12, 13, 16, & 17
	Cross-Sections I-I', J-J', and K-K'
21	Final Grade Cross-Sections, Units 1, 2, 3, & 5
	Cross-Sections A-A', B-B', C-C', D-D', E-E', and F-F'
22	Final Grade Cross-Sections, Units 9, 10, 11, 12, 13, 16, & 17
	Cross-Sections G-G' and H-H'
23	Final Grade Cross-Sections, Units 9, 10, 11, 12, 13, 16, & 17
	Cross-Sections I-I', J-J', and K-K'
24	Construction Details
25	Construction Details

### 2.3 SCHEDULE OF CLOSURE

Proteco will begin closure activities upon its receipt of approval of the Closure and Post Closure Plan by the USEPA. The anticipated closure schedule is presented in Figure 2.1. The area of the waste units is approximately 5 acres and work required to construct the RCRA closure includes clearing and grubbing, backfilling, placement of the low permeability layer, installation of geosynthetics, placement of a minimum 2 feet thick cover layer, erosion and sediment controls, and a gas management system.

Figure 2.1

### 3.0 CLOSURE COVER DESIGN

---

Closure will be initiated by grading the waste units to the proposed sub-base elevations which vary between 3 and 8 percent over the closure cover and 50 percent on side slopes. Subsequently a RCRA closure cover will be constructed over all areas where waste has been disposed. The waste unit closure covers will consist of a low permeability layer, a 40 mil high density polyethylene (HDPE) geomembrane, a nonwoven geotextile, an 18 inch cover layer, and a 6 inch surface armor layer.

As discussed in the CAMU proposal, Wastes from Units 9, 4, and 7 will be excavated, treated, and placed back into a newly constructed RCRA cell encompassing Waste Unit 9 and adjacent areas (See Figure 2 of CAMU proposal). The technical approach for constructing this CAMU cell containing treated waste from these units are discussed separately in the CAMU. However, closure cap design requirements as discussed in this document and supplementary plans i.e., CQAP, specifications, etc., are directly applicable for the CAMU cell.

#### 3.1 CLOSURE COVER FOUNDATION

The site will be cleared of existing vegetation or debris in preparation for placement of the RCRA closure cover. It will be graded to provide a slope between 3 and 8 percent over the actual waste units and up to 50 percent on the surrounding slopes. Common fill will be obtained from off site and/or on site borrow areas to establish the sub-base for the closure cover.

##### 3.1.1 Settlement Potential

Settlement tests were conducted on Waste Units 1 and 16. Waste Unit 1, a drum burial unit, was chosen as a unit where maximum settlement would likely occur because of the nature of deteriorating drums. A test fill approximately 50 feet by 50 feet and 6 feet high was placed over a 3 feet by 3 feet x 1/6 inch steel plate. A steel rod attached to the plate was periodically surveyed to monitor the settlement. Settlement data shown in Appendix I of the Design Report indicates that settlement of 0.017 feet in 2 months occurred at Waste Unit 1. Since Waste Units 2, 3, and 5 are also drum burial units, the anticipated settlement is expected to be similar to Waste Unit 1. A conservative linear extrapolation of this data would be 0.102 feet of settlement in a year.

To generate information that would be representative of settlement throughout the remaining waste units, Waste Unit 16 was identified for testing. Waste filling operations that were conducted in Waste Unit 16 are similar to those conducted in Waste units 9, 10, 11, 12, 13, and 17. The settlement test results for Waste Unit 16 indicate 0.023 feet of

settlement occurred. A conservative linear extrapolation for this data indicates 0.138 feet would occur in a year.

To prevent grade reversals and ponding of water on the closure cover the slopes for the closure have been chosen to account for settlement indicated in the load tests. As part of the waste unit closure, heavy equipment will be used to perform clearing and grading operations and to place and compact the sub-base and low permeability layer. This equipment will further compact the waste units prior to placement of the final geosynthetic and soil closure system. In addition, the surcharge load on the waste has been reduced by replacing a 12 inch thick layer of sand in the drainage layer with a 16 ounce per square yard nonwoven geotextile.

### **3.1.2 Bearing Capacity and Stability**

Additional compaction of the site will occur with the placement of the sub-base and low permeability layer. For the reasons discussed in Section 3.1, the existing landfill is judged to have sufficient bearing capacity for the closure cover. The HDPE geomembrane material was selected for its flexibility and durability in the event settlement does occur.

Preparation and placement of a low permeability layer is required to cushion and support the geomembrane. The compacted sub-base and low permeability layer will support the geomembrane and protect it from irregularities during the post closure period.

The nonwoven geotextile and cover layer will be placed soon after installation of the geomembrane. No vehicles will be allowed to drive directly on the geomembrane. The cover layer will be used as a bridge for equipment movement on the installed geosynthetics. The cover layer will be placed at the base of the slopes and pushed up the slopes to prevent damage to the underlying geosynthetics. Equipment used in construction of the closure cover will be limited to 6 pounds per square inch (psi) or less ground contact pressure. As sections of the cover layer are completed, the surface armor will be placed. The CQA Plan discusses inspections, monitoring, and testing to be performed to ensure the low permeability layer is properly installed to support the geomembrane.

## **3.2 CLOSURE COVER SYSTEM**

The closure cover will be constructed and closure will proceed as follows:

- The site will be cleared and grubbed to ensure adhesion between the existing soil and the closure cover. Common fill will be placed to establish the sub-base for the closure cover as required to achieve the desired elevations.
- A soil low permeability layer having a hydraulic conductivity no greater than  $1 \times 10^{-7}$  cm/s will be placed on top of the sub-base.

- Gas vents will extend into the waste and protrude through the closure cover to intercept and discharge gas generated from the waste.
- A 40-mil thick geomembrane consisting of a HDPE smooth surfaced geomembrane will be placed on the sub-base to prevent infiltration of precipitation through the cover and into the underlying waste. The geomembrane will provide maximum flexibility to conform with any settlement which may occur. The liner will have enough tensile strength and durability to withstand the applied weight of the cover and surface armor layers for the duration of the closure and post closure periods without breakdown or reduced ability to perform as designed.
- A 16 ounce per square yard nonwoven geotextile will be placed on top of the HDPE geomembrane to protect the geomembrane and provide drainage.
- A 2 feet thick soil layer consisting of an 18 inch cover layer of compacted common fill and a 6 inch surface armor layer will be placed over the geotextile. These soil layers will protect the underlying geosynthetic layers from mechanical damage.

### 3.3 GEOMEMBRANE LINER

#### 3.3.1 Materials Specification

The 40 mil thick smooth geomembrane will be constructed of high density polyethylene (HDPE). Raw polymer specifications and manufactured sheet specifications for the HDPE geomembrane are as follows:

- |                                       |                   |
|---------------------------------------|-------------------|
| • Thickness (ASTM D-751)              | ≥40 mil           |
| • Density (ASTM D-1505 Method A)      | ≥0.935 g/cc       |
| • Carbon black content (ASTM D-1603)  | ≥2%               |
| • Tensile properties (ASTM D-638)     |                   |
| Stress at yield                       | ≥160 lbs/in width |
| Strain at yield                       | ≥13%              |
| • Tear resistance (ASTM D-1004)       | ≥30 lbs/in width  |
| • Puncture Resistance (FTMS 101B)     | ≥52 lbs           |
| • Dimensional Stability (ASTM D-1204) | +/-2.0%           |

- Melt Index (ASTM D-1238) 0.1 to 1.0 g/10 min
- Stress crack resistance (ASTM D-1693)  $\geq 1200$  hours
- Seam Shear Strength (ASTM D-4437)  $\geq 80$  lbs/in width
- Seam Peel Adhesion (minimum peel)  
(ASTM D-4437)  $\geq 57$  lbs/in width (hot weld)  
 $\geq 48$  lbs/in width (extrusion weld)

Further details on these material requirements are provided in the Construction Specification and the CQA Plan.

### 3.3.2 Physical Stresses

The geosynthetic materials used to construct the closure cover will provide liner integrity under a variety of mechanical stresses. The required calculations of physical stresses and friction factors are included in Appendix J of the Design Report.

These calculations include:

- Ability of the geomembrane to survive differential settlement
- Ability of geomembrane to survive settlement of underlying soil and waste layers
- Ability of soil cover to remain on geosynthetics

### 3.3.3 Differential Settlement in the Sub-base

Visual inspection of the site indicated no major depressions and satisfactory compaction of the waste at the time of filling. During clearing and grubbing operations and placement of soil fill to establish the sub-base and low permeability layer for the closure cover, further compaction will occur. For these reasons, further settlement resulting in foundation compression and soil liner compression is expected to be minimal. Problems with long term and differential settlement resulting in depressions which can strain the geomembrane are addressed in Appendix I of the Design Report. The Circular Trough Model (Knipschild 1985) which encompasses biaxial and uniaxial settlement was used to determine the required strength of the closure cover. An estimate of 10% settlement was assumed for the calculation. The selected geomembrane will be constructed of HDPE which allows large values of elongation and strain without breaking and provides a flexibility allowing the geomembrane to conform to depressions caused by waste settlement. The calculation shows that the design ratio for the closure cover to be 107 for settlement resulting from long term waste compression. This is much larger than the design ratio at rupture, which was shown by Knipschild (1985) to be 5.0. The factor of safety for differential settlement was

determined to be 21.4 which indicates that the geomembrane will be able to survive differential settlement in the waste units.

#### **3.3.4 Strain Requirements at the Anchor Trench**

The geomembrane will be anchored in a trench at the toe of the closure cover. A detail drawing of the anchor trench is shown on the Project Drawings. Strain on the geomembrane is of concern in design of liners for the bottom of a landfill because anchoring prevents sliding of the liner downhill. In the case of the geomembrane closure cover, the anchor trench does not affect the potential for sliding because it is at the toe rather than at the top of the slope. For these reasons, calculation of strain requirements of the anchor trench is not applicable.

#### **3.3.5 Strain Requirements Over Long Side Slopes**

The geomembrane must be strong enough to resist tensile forces acting on the geomembrane from the weight of the soil above. The selection of geomembrane provides high strength during installation. The steepest slope of the closed area will be 8 percent with areas beyond the geomembrane having a maximum slope of 50 percent, which will allow safe operation of maintenance equipment over the entire site. At an 8 percent slope, the frictional resistance of 14' plus adhesion available from the geomembrane is adequate to resist the driving forces on the hill and will not slide, as shown in Appendix J of the Design Report.

#### **3.3.6 Chemical Compatibility**

Typically, HDPE geomembranes and geotextiles are nonreactive with most leachate constituents (Koerner, 1986). The HDPE geomembrane and geotextile will be placed at least 24 inches above the top of the buried waste in the waste units and, therefore, will not contact chemicals in the waste units. The geomembrane will be in direct contact with the low permeability layer and the geotextile. The only liquid contacting the HDPE geomembrane and geotextile will be precipitation that percolates through the cover layer.

#### **3.3.7 Liner Strength Requirements and Integrity Under Mechanical Stresses**

The geomembrane must be capable of withstanding both the stresses of installation and stresses after placement. The 40 mil thick HDPE geomembrane is suitable for both conditions. The thickness and flexibility of the HDPE will provide sufficient strength to withstand installation stresses such as wind, temperature and seaming. As previously discussed, the geomembrane will be placed on the low permeability layer, free of rocks, clods, and other debris that might puncture the geomembrane. No vehicles will be driven on the geosynthetics until the cover layer is placed.

Prior to installation, the geomembrane will be protected from sunlight and the weather by a cover or a temporary shelter. After placement, the geomembrane will be covered with the

geotextile and cover layer as quickly as possible after approval of seaming. The 2 feet thick cover layer will provide long term protection from mechanical and thermal stresses. Except during installation, the geomembrane will not be exposed to wind, sunlight, or direct precipitation.

#### **3.3.8 Friction Factor**

Smooth surfaced geomembrane will be used to cover the waste units. The maximum slope of the waste unit sub-base for all the waste units is 8 percent. The edges of the waste units have slopes as steep as 50 percent where the geomembrane will cover short distances before it is terminated in an anchor trench. It is shown in the calculations in Appendix J of the Design Report that the frictional resistance of 14 degrees that is available from the geomembrane is adequate to prevent sliding of the geomembrane on the average 5 percent slopes and the anchor trenches. The resistance available on the 5 percent slopes is also adequate to prevent sliding on the steeper 50 percent slopes around the edge of the waste units.

In the final design of the closure cover for the waste units, an HDPE geomembrane has been substituted for the PVC geomembrane liner that was proposed in the first draft of the closure cover design. During the design phase, pullout testing was performed on PVC geomembrane and the site soil by GeoSyntec Consultants of Atlanta, Georgia. The geomembrane tested was a 20 mil thick PVC smooth surfaced geomembrane liner supplied by Staff Industries. The site soil for construction of the waste units closure covers tested is clay (CL) as described in the geotechnical report from Caribbean Soil Testing Co. Inc. that is included in Appendix F of the Design Report. The results of the pullout testing program, reported in a letter report dated September 28, 1994 from GeoSyntec Consultants included in Appendix E of the Design Report, indicates that there is a peak friction angle of 14 degrees and peak adhesion of 99 pounds per square foot between the PVC geomembrane and the site soil.

With the change in geomembrane material from PVC to HDPE to be used in the closure cover there is a question as to the applicability of the pullout testing that was performed on the PVC geomembrane and the site soil. Koerner (1990) reports results of pullout testing that was performed on geomembrane consisting of various substances including HDPE and PVC. The results listed in Table 3.1 indicate that clay soils such as CL-ML and CL provide pullout results for friction angle and adhesion that are virtually the same for HDPE and PVC.

#### **3.3.9 Best Anchorage Configuration for the Geomembrane**

As discussed in 3.3.4 the anchorage of the geomembrane is not a design issue. The geomembrane will be anchored in a 2 feet wide, 2 feet deep trench located at the edge of the closure cover around the perimeter of the waste units. This is a typical anchoring method

shown in the guidance document and is used primarily to protect against wind damage to the geomembrane.

#### **3.3.10 Cover Layer Stability on Top of Geomembrane**

Stability of the cover layer is an important concern in designing a landfill cap. Sliding stability was evaluated for smooth HDPE on the waste units where it will be placed at slopes up to 8 percent. Approximately 70 percent of the cover layer that will overlay the geomembrane is at an average slope of 5 percent, the factor of safety against a sliding block failure is greater than 1 at 1.8. The approximately 30 percent of the cover layer that is at an 8 percent slope has a factor of safety of 1:1 which also greater than 1. The areas where the cover layer will be at a 50 percent slope are short and the soil is keyed into the underlying so that the soil is preventing from sliding. Because all the sections will be connected, an overall factor of safety can be considered as appropriate. Calculations are included in Appendix J of the Design Report.

#### **3.3.11 Installation**

The earthwork contractor will be responsible for preparing and maintaining the sub-base and low permeability layer in a condition suitable for liner installation. The low permeability layer will be smooth and firm. Sharp stones, gravel, debris, or any other objects which could penetrate the liner will be removed. The low permeability layer will be visually inspected prior to installation of the geomembrane.

The geomembrane will be delivered to the site on rolls, stored off the ground in small stacks, and protected with a covering or a temporary storage shelter. The storage space will be protected from theft, vandalism, and passage of vehicles. Geosynthetics will be handled in a manner to prevent physical damage, contamination, and exposure.

Geomembrane will be installed during dry, moderately warm weather to minimize the effects of thermal expansion and contraction. The manufacturer's instructions will be followed for geomembrane placement and seam overlap. The method used to unroll the panels will not cause scratches or crimps in the geomembrane. Sandbags will be placed along the edges of the geomembrane to prevent uplift pressures and the resulting wind damage. Field panels will be placed one at a time in a manner which minimizes wrinkles.

The panels will be seamed immediately after placement following the manufacturer's recommended thermal sealing procedures. The ambient temperature shall be above 35° F during seaming. Surfaces to be seamed will be clean and dry when the seams are made. Seams will be oriented parallel to the line of maximum slope. All field seams will be nondestructive tested in accordance with ASTM D-4437 seam evaluation using the vacuum box technique. Destructive tests will be performed on test specimens in accordance with

ASTM D-413 and ASTM D-638 for peel and shear of geomembrane seams. One sample will be taken for destructive testing a minimum of every 500 linear feet of weld.

The geomembrane will be covered within the time limits specified by the manufacturer. The geotextile and cover layer will be placed on the geomembrane as soon as possible after approval of the geomembrane placement. The cover layer will be placed on the geosynthetics using rubber tired or tracked vehicles. Vehicles will be driven at least 12 inches of the cover layer. Vehicles will not be allowed to drive directly on the geosynthetics.

CQA procedures to be followed for geomembrane and geotextile installation, including inspections, material certifications, and testing are discussed in the project CQA Plan.

### 3.4 COVERAGE

Records of waste placement are not available for the waste units. Therefore, geophysical studies, aerial photography, employee interviews, site inspections, and test pits have been used to determine the area and boundaries of the waste units. Based on information from these sources, it was determined that the waste units are located as shown on the design drawings. The entire area will be covered by the RCRA closure cover.

Table 3.1 – Friction Values and Efficiencies for Various Clay Soils to Various Geomembranes

Description	Soil No. 1 ML-CL				Soil No. 2 CL-ML			
	c	E <sub>c</sub> (%)	φ	E <sub>φ</sub> (%)	c	E <sub>c</sub> (%)	φ	E <sub>φ</sub> (%)
Soil-to-soil	9.0	100	38	100	12.0	100	34	100
	c <sub>a</sub>	E <sub>c</sub> (%)	δ	E <sub>δ</sub> (%)	c <sub>a</sub>	E <sub>c</sub> (%)	δ	E <sub>δ</sub> (%)
Geomembrane-to-soil								
PVC	8.5	94	39	100	3.7	31	23	69
CPF	8.0	89	40	100	3.2	27	24	71
EPDM	5.0	55	33	87	5.0	42	23	67
HDPE	5.0	88	26	68	2.0	17	23	67
Embossed HDPE	9.0	100	35	92	11.0	92	29	58
Description	Soil No. 3 ML-CL				Soil No. 4 CL-ML			
	c	E <sub>c</sub> (%)	φ	E <sub>φ</sub> (%)	c	E <sub>c</sub> (%)	φ	E <sub>φ</sub> (%)
Soil-to-soil	20	100	30	100	25	100	24	100
	c <sub>a</sub>	E <sub>c</sub> (%)	δ	E <sub>δ</sub> (%)	c <sub>a</sub>	E <sub>c</sub> (%)	δ	E <sub>δ</sub> (%)
Geomembrane-to-soil								
PVC	14.0	70	16	53	7.0	28	24	100
CPF	13.0	65	17	57	8.0	32	23	96
EPDM	8.0	40	23	77	7.5	30	20	83
HDPE	14.0	70	15	50	3.0	12	21	88
Embossed HDPE	18.0	90	27	90	15.0	60	26	100
Description	Soil No. 5 CL-SP							
	c	E <sub>c</sub> (%)	φ	E <sub>φ</sub> (%)				
Soil-to-soil	28	100	22	100				
	c <sub>a</sub>	E <sub>c</sub> (%)	δ	E <sub>δ</sub> (%)				
Geomembrane-to-soil								
PVC	12.0	43	17	77				
CPF	10.0	36	19	86				
EPDM	9.0	32	18	82				
HDPE	14.0	50	15	68				
Embossed HDPE	16.0	57	25	100				

Note: c and c<sub>a</sub> are in units of kN/m<sup>2</sup>, φ and δ are in degrees.

## 4.0 LEACHATE, SUBSURFACE, AND SURFACE WATER

---

### 4.1 LEACHATE MONITORING SYSTEM

The existing waste units have no bottom liner or Leachate Collection System (LCS). During various site inspections, no leachate has been detected seeping out of the waste units along the perimeter. Placement of the RCRA closure cover will reduce percolation of surface water into the waste units, thus reducing any leachate production.

The Hydrologic Evaluation of Landfill Performance (HELP) model (Version 2.05) was used to estimate the volume of water that will percolate into the waste. This model estimates the amount of precipitation that will seep through the RCRA cap. HELP model analyses were performed for a conservative situation representing a slope length of 200 feet and a slope of 3 percent. Rainfall and temperature data for the region of Penuelas, Puerto Rico and evaporation data for San Juan, Puerto Rico, was used in the computer model. No compaction was assumed in the 6 inch surface armor layer. However, the 18 inch cover layer was modeled as compacted, reducing infiltration of water through the closure cover. Detailed results of these HELP model analyses are provided in Appendix A of the Design Report.

To monitor the surrounding area for leachate which may emanate from the waste units, three monitoring wells will be installed downgradient of the facility as shown in the Project Drawings. The monitoring program that will be conducted will be a continuation of the existing program. The program which describes the parameters to be analyzed, the frequencies that testing will be conducted, and the criteria for the data are described in Part B Permit for the facility.

### 4.2 DRAINAGE LAYER DESIGN

To ensure the integrity of the geomembrane, it is necessary to maintain less than 12 inches of head on the geomembrane. This will be accomplished with the installation of a lateral drainage layer, consisting of 16 ounce per square yard nonwoven geotextile with a minimum transmissivity of  $14.5 \times 10^{-3} \text{ ft}^3/\text{min.}/\text{ft.}$  The HELP Model analyses were used to determine the required transmissivity of the geotextile beneath the final cover. At a 5 percent slope, the transmissivity was calculated to be  $3.8 \times 10^{-3} \text{ ft}^3/\text{min.}/\text{ft.}$  which yields a factor of safety of 3.8. The HELP model analyses were also used to calculate the maximum head on the geomembrane and the amount of run-off from the closure cover for the longest lengths of the 5 percent slope. These slopes were identified as the worst case scenarios and used for design of all the waste units. The results of these HELP model calculations, presented in Appendix A of the Design Report indicate that the maximum peak daily head of

0.03 inches will occur on the liner. This value is well below the maximum allowable head of 12 inches.

The HELP model calculations indicate the daily peak run-off from the cap will be 25,070.00 cubic feet per acre and the daily peak drainage from the lateral drainage layer will be 105.00 cubic feet per acre.

#### **4.3 RUN-ON CONTROL**

Because the waste units are located on ridges and hills, run-on of surface water is not a concern. Extensive permanent drainage channels and sediment basins are part of the closure design as shown in the Project Drawings. These surface water control features will be used to route any stormwater run-on around and through a stormwater retention or diversion system.

#### **4.4 RUN-OFF CONTROL**

Run-off from the closure cover will be controlled by several measures. Run-off from the waste units will be controlled through permanent drainage channels constructed along the perimeter of the waste units. Silt fences will be used to control the flow of surface water from the waste unit area to the permanent sediment basins that will be constructed to collect run-off during construction of the closure cover. The control measures, channels, and silt fences will be relocated and reinstalled as necessary to accommodate the waste unit closure cover construction.

## 5.0 GAS MANAGEMENT SYSTEM

---

The following section describes the design and procedures for gas venting and control of decomposition gases within the waste units. The gas management system includes passive gas vents at various locations within the limits of the waste units to discharge gas generated in the waste.

### 5.1 GAS PRODUCTION AND MIGRATION

The waste units are located in a remote section of the Proteco facility with no structures located within 300 feet. Site inspections found that vegetative growth around the facility was not stressed and there were no indications of gas migration beyond the waste units. Currently, there is no evidence of gas production or release from any of the waste units. Because the waste units have been out of operation for approximately 10 years, gas migration pathways most likely have been established. Underground cracks and fissures between waste lifts and cells caused by settlement and subsidence are probable migration pathways. Any such channels within the waste will provide routes for gas migration to the gas vents that penetrate the closure cover.

The majority of waste gas is produced from the decomposition of the organic fraction of municipal solid waste (MSW). The total gas production (assuming normal conditions) is reported to reach a peak in 6 years or less (Tchobanoglous et al., 1993). Since operations have been terminated for 10 years, there is likely minimal gas production. To estimate the amount of gas produced at the waste units, the following assumptions have been made:

- The source of gas production is the MSW fraction because hazardous waste produces minimal gas.
- The facility is a hazardous waste disposal facility and there is no MSW within the waste units.

A volume estimate of the total amount of gas generated by the waste units is 7.5 cubic feet per minute, based on Bagchi, 1990. The calculation is based on typical gas production rates of landfills in the pseudo-steady-state stage of gas production. Because of the content of the waste units, low methane production rates are expected. The calculations for this estimate are in Appendix K of the Design Report.

## 5.2 PASSIVE GAS VENTS

Passive gas vents will be placed at high points within the waste units to discharge gas generated in the waste. Details of the vents are shown in the Project Drawings. To construct each passive unit, a 12 inch deep trench will be excavated in the compacted sub-base. Horizontally at the bottom of the trench, a 4 inch diameter, perforated HDPE pipe will be placed on 4 inches of #57 stone. A 4 inch diameter HDPE vent pipe will then be connected to the horizontal 6 inch pipe and routed up for exit above the closure cover. The remainder of the trench will be filled with #57 stone to the surface of the sub-base. The area will be covered with low permeability layer soil, geomembrane, geotextile, cover layer, and surface armor. An HDPE boot will be constructed around the vent pipe to maintain the integrity of the geomembrane. The pipe will extend 4 feet above the final grade of the closure cover to allow gases to discharge into the atmosphere.

## 6.0 CONSTRUCTION QUALITY ASSURANCE PLAN

---

The purpose of the Construction Quality Assurance (CQA) Plan is to ensure that design of the RCRA closure cover complies with the hazardous waste regulations and construction of the RCRA closure cover conforms with the Closure and Post Closure Plan and construction documents. The Closure and Post Closure Plan, which was prepared to comply with CFR 264, is the basis for the construction plans and specifications. A copy of the CQA Plan will be kept at the Proteco office at the landfill site during closure activities. The plan will be available for review by regulatory agencies upon request.

The Project Drawings and Construction Specifications, which are separate documents, detail the requirements for placement of the RCRA closure cover on the waste units. A typical section of the RCRA closure cover and cross sections of the waste units are shown in the Project Drawings. The quality assurance activities discussed in this plan summarize the requirements of the CQA Plan and describes the quality assurance activities to be performed by Proteco or its designated representative.

### 6.1 RESPONSIBILITY AND AUTHORITY

The USEPA is the permitting agency responsible for the review and approval of the Closure and Post Closure Plan, the CAMU proposal, Construction Specifications, and the CQA Plan. The USEPA also will review the construction quality assurance documentation for the RCRA closure cover.

Proteco is the owner of the waste units and is responsible for the design, construction, and post closure care of the closed units. Proteco has direct responsibility for implementing the closure plan and providing the post closure care during the 30 year post closure period.

Proteco or their designate will serve as the construction quality assurance officer/inspector during construction of the closure covers of the waste units. Throughout this section reference to Proteco will also mean Proteco's designated CQA consultant. Proteco's responsibilities include being familiar with the Closure and Post Closure Plan, Project Drawings, Construction Specifications, and CQA Plan so that interpretation and clarifications can be made, scheduling and coordinating quality assurance activities, inspecting construction activities to ensure conformance with the construction documents, maintaining communication between the various parties involved, confirming accuracy of data, review and interpretation of data, ensuring the construction contractor is performing quality assurance activities, reporting results of the quality assurance activities, and making recommendations concerning acceptance of the construction contractor's work.

The construction contractor will be retained by Proteco to construct the RCRA closure cover on the waste units in accordance with the approved Closure and Post Closure Plan, CAMU proposal and construction documents. Requirements for contractor construction quality control are included in the Construction Specifications, CQA Plan, and the contractor's basic contract.

## **6.2 MEETINGS AND REPORTS**

Periodic meetings will be held to monitor the progress of the project and issues arising during construction of the RCRA closure cover. The meetings will be scheduled by Proteco and the attendance will depend on the issues being addressed. Potential attendees will include representatives from the USEPA, the construction contractor, and the design engineer. All meetings will be documented in writing.

A preconstruction meeting to review all project requirements, in particular quality assurance requirements, will be held before work begins on the site. Topics of discussion will include: quality assurance documents, roles and responsibilities of each entity, establishing lines of authority and communication, procedures for inspecting work and reviewing data and other documents, and changes that need to be made before actual construction begins.

The construction contractor will be required to submit a daily report summarizing work accomplished the previous day, work planned for the current day, personnel and equipment to be used, and potential problems. When necessary, meetings will be held to address specific problems or deficiencies and develop resolutions.

## **6.3 PERSONNEL QUALIFICATIONS**

Proteco or its designated CQA consultant will serve as the construction quality control officer for the project. The representative assigned to the project will have adequate formal training and practical field experience to ensure proper quality assurance during the construction of the RCRA closure cover. He will be present during construction and be responsible for inspecting relevant activities to ensure compliance with the construction documents.

As necessary, the design engineer will provide technical assistance and support to Proteco. The design engineer's representative will be familiar with the specifics of the project and will have appropriate experience.

The construction contractor will be required to provide a quality control officer for the project. The contractor's quality control officer will be responsible for review and approval

of all submittals required by the Construction Specifications and ensuring the requirements of the CQA Plan are met.

#### **6.4 INSPECTION ACTIVITIES**

The quality assurance activities for the project include construction materials quality control and construction quality assurance. Construction materials quality control ensures that the materials used comply with the Construction Specifications. The Construction Specifications and CQA Plan provide a detailed listing of all the quality assurance testing, methodologies, frequencies, etc. that are discussed in the following sections. The purpose of construction quality assurance is to ensure that the RCRA closure cover is constructed in compliance with the construction documents. Upon completion of installation of each component, the component will be inspected to identify any damage that may have occurred during its installation or during construction of another component. Any damage will be repaired and these corrective measures will be documented in quality assurance records.

##### **6.4.1 Sub-Base Layer**

Prior to placement of the RCRA closure cover, the waste units will be cleared and grubbed to remove grass, brush, and small trees and prepare the site for the closure cover. The area to be covered will be graded to provide a slope typically between 3 and 8 percent. Grading of the site to establish the sub-base for the RCRA closure cover will be accomplished by addition of backfill obtained from off-site if necessary. The backfill used to establish the sub-base for the closure cover will be common fill as specified in the construction documents. The backfill material will be visually inspected as it is placed to ensure it meets the Construction Specifications and does not contain objects that could damage or adversely affect overlying layers of the closure cover. The site CQA representative will observe placement of the fill in 9 inch loose lifts to achieve a 6 inch thick compacted layer. Proteco will be responsible for performing tests to document achieving 95 percent compaction in accordance with ASTM D 698 (Standard Proctor). This will minimize the potential for settlement and subsidence in the future. The site CQA representative will review and approve test results. Other geotechnical tests will be performed on this layer to ensure that it fulfills the Construction Specifications. Those inspections are detailed in both the Construction Specifications and the CQA Plan.

##### **6.4.2 Gas Management System**

The materials used in the construction of the gas vents in the landfill will be inspected by the site CQA representative upon delivery to the site. Certifications, manufacturer's literature/specifications, and other information will be reviewed to ensure conformance with the specifications. Installation of the vents will be observed to assure compliance with the construction plans and specifications.

#### 6.4.3 Low Permeability Layer

Two feet of a low permeability (hydraulic conductivity  $\geq 1 \times 10^{-7}$  cm/sec) clay will be placed on the sub-base to prevent infiltration of surface water into the waste units. The manufacturer will provide certification that the material properties listed in the Construction Specifications have been met before the soil is accepted for placement on the waste units. Placement of the low permeability layer will be in accordance with the Construction Specifications.

A small scale test pad will be constructed to ensure the design permeability can be achieved. The test pad will be a minimum of 40 feet by 40 feet in size and will be constructed on or near the waste units. The test pad will be used to determine the optimum moisture content of the low permeability layer, the number of equipment passes required to achieve the required compaction, and the in-situ permeability of the low permeability layer, and other site specific construction requirements. The experience gained during the test pad construction and testing will be used to finalize the procedures to be used in actual low permeability layer placement.

Prior to placement of the low permeability layer, the surface will be surveyed to obtain data for as-built submittals.

#### 6.4.4 Geomembrane

A 40 mil thick smooth surfaced HDPE geomembrane will be installed above the low permeability layer. The supplier will provide documentation confirming that the raw polymer material and manufactured sheet will comply with the Construction Specifications. The supporting surface of the geomembrane will be inspected prior to seaming to ensure the surface is acceptable. Sandbags will be placed along the edges of the geomembrane to control panel uplift by wind. Surfaces to be seamed will be clean and dry when the seams are made. Field seaming will occur during dry, moderately warm weather at temperatures no lower than 35 degrees Fahrenheit. Manufacturer's instructions will be followed when sealing around gas vents penetrating the geomembrane. The material requirements for the geomembrane, the quality assurance testing methods, and the installation methods for the geomembrane are described in the Construction Specifications and the CQA Plan.

Destructive trial seams will be conducted to determine the integrity of the geomembrane field seams. Destructive tests include peel and shear test performed on fragment portions of geomembrane by an independent laboratory prior to commencing seaming activities and at periodic intervals throughout the day. Additionally, destructive peel and shear field tests are to be performed on destructive samples from the installed seams. These samples

may be collected randomly or in areas of suspect quality. Destructive samples of installed seam welds will be cut into several pieces and distributed to:

- The installer to perform construction quality control field testing,
- Proteco to retain and appropriately catalog or archive, and
- An independent laboratory for peel and shear testing.

A quality control technician will monitor each seam crew and perform a visual inspection. This technician will be aware of the effects of weather, temperature, humidity, and cloud cover on the geomembrane.

Nondestructive test methods to be conducted in the field on the in-place geomembrane to determine the integrity of the geomembrane seams are the pressure test, vacuum box test or the air lance technique. The criteria for this testing is listed in the Construction Specifications and the CQA Plan.

The site CQA representative inspection personnel will be aware of the effects that weather conditions may have on the geomembrane and seaming procedures. If the weather becomes unacceptable for geomembrane installation, the CQA representative will recommend stopping installation until conditions are favorable.

#### **6.4.5 Geotextile**

To protect the geomembrane and provide drainage, a 16 oz/sy nonwoven geotextile will be placed across the entire geomembrane. Placement of the geotextile will be observed to ensure complete coverage of the geomembrane, proper overlap, and compliance with the manufacturer's instructions. The material requirements for the geotextile are presented in the Construction Specifications and the CQA Plans.

#### **6.4.6 Cover Layer**

The 2 feet thick cover layer will consist of 18 inches of common fill and 6 inches of surface armor which will be placed above the geotextile. During construction of the cover soil layer, a site CQA representative will monitor the uniformity of the application process, observe the placement procedure to ensure that the soil is compacted properly, and measure the thickness and slope of the topsoil layer. Inspection personnel will also ensure that care is taken near gas vents to prevent damage by construction equipment.

The common fill will be visually inspected as it is placed to ensure that it meets the Construction Specifications and does not contain objects that could damage underlying layers of the closure cover. The site CQA representative will observe placement of the fill in 9 inch loose lifts. The common fill will be compacted to 95% of the maximum Standard Proctor dry density. The site CQA representative will be responsible for performing tests

for moisture content and density on the common fill . The site CQA representative and Proteco will review and approve test results.

## 7.0 POST CLOSURE ACTIVITIES

---

### 7.1 POST CLOSURE CONTACT

During the post closure care period, information about this hazardous waste site and any activities at the site can be obtained from Proteco at the following address and from the following contact points:

Proteccion Tecnica Ecologica, Inc.  
Doctor Jorge Fernandez  
P.O. Box 71331  
San Juan, PR 00936-8431  
(809) 272-8411

Proteccion Tecnica Ecologica, Inc.  
Rene Rodriguez  
Carr. 385 KM 3.5  
Penuelas, PR 00624  
(809) 836-2058

### 7.2 POST CLOSURE STANDARDS

Post closure care will be performed in accordance with 40 CFR 264. During final closure activities at the waste units, a copy of the approved Closure and Post Closure Plan shall be furnished to the USEPA regional administrator Director upon request, including request by mail. After final closure has been certified, Proteco will keep the approved Closure and Post Closure Plan on file during the remainder of the post closure period. After final closure, Proteco will:

- Maintain the integrity and effectiveness of the final cover, including making repairs to the closure cover as necessary to correct the effects of settling, subsidence, erosion, or other events.
- Prevent run-on and run-off from eroding or otherwise damaging the final cover, and maintain the surface drainage system including the sediment basins and channels
- Protect and maintain surveyed benchmarks.

Post closure care for the waste units will begin after completion of closure and continue for 30 years. The USEPA Regional Administrator Director may shorten or extend this post closure period if doing so will protect human health and the environment.

Post closure use of the waste units shall never be allowed to disturb the integrity of the final closure cover, unless the USEPA Regional Administrator Director finds that the disturbance is:

- Necessary to the proposed use of the closed waste units, and will not increase the potential hazard to human health or the environment, or
- Necessary to reduce a threat to human health or the environment.

Proteco understands that if any future activities are carried out at the closed waste units, the USEPA Director will be informed in writing. At this time, there are no plans to use the closed waste units. Signs posted along the waste units' boundaries will warn that breaking of the ground surface is prohibited. This notice is designed to ensure the integrity of the closure cover is not disturbed.

### 7.3 SURVEY PLAT

When the certification of closure of the waste units is submitted, Proteco will submit a survey plat indicating the location and dimensions of the closed waste units with respect to permanently surveyed benchmarks to the local zoning authority with jurisdiction over local land use and the USEPA Regional Administrator Director. The survey plat will be prepared and certified by a professional land surveyor registered in Puerto Rico. The plat will be filed with the local zoning authority, or the authority with jurisdiction over local land use, will contain a note, prominently displayed, which states Proteco's obligation to restrict disturbance of the closed disposal area.

### 7.4 SECURITY CONTROLS

The area is presently surrounded by a security fence. This fence will be maintained to ensure that access to the site is controlled. Signs which state: "Warning-Disturbing Soil Surface Prohibited" will be posted in locations at the closed disposal area to ensure the area is not disturbed. Signs which state: "Danger - Keep Out Authorized Personnel Only" will be posted at the entrance gates.

## 7.5 INSPECTION, MONITORING, AND MAINTENANCE

### 7.5.1 Certification of Closure

Within 60 days of completion of closure, Proteco shall submit to the USEPA, by registered mail, a certification that the waste units were closed in accordance with the construction documents in the approved Closure and Post Closure Plan. The certification will be signed by the owner or operator and by an independent registered professional engineer registered in Puerto Rico. Documentation supporting the independent registered professional engineer's certification will be furnished to the Director upon request.

### 7.5.2 Inspections

An inspection program shall be established to inspect the surface armor layer, erosion control measures and all other physical aspects of the site. Initially, Proteco will make these inspections on a monthly basis or more frequently, as necessary. In addition, the site will be inspected annually by a professional engineer registered in Puerto Rico for the first two years after completion of closure. For the remainder of the normal post closure period, the site shall be inspected quarterly by Proteco. A log of all inspections and any resulting maintenance work will be kept on file at Proteco. Copies will be sent to the USEPA. If the engineer discovers a deficiency in the closure cover of the waste units, this deficiency will be noted and corrective action will be initiated within 14 days. Table 7.1 presents a sample inspection log.

The following items will be inspected and maintained during the post closure care period:

- Security controls
- Final cover
- Run-off controls
- Benchmarks
- Erosion controls
- Surface armor layer maintenance
- Gas management system

The following post closure inspection schedule is suggested for the site but should be modified as experience dictates:

First two years of closure:

- a) After every major storm event, Proteco shall inspect the site to assure that excessive erosion or other damage has not occurred.
- b) A complete inspection of the site including all security facilities will be made monthly by Proteco. All repairs made will be noted.

- c) A professional engineer registered in Puerto Rico will inspect the site annually. One copy of the inspection report will be submitted to the USEPA.

After the first two years of closure:

- a) After every major storm event, Proteco will inspect the site to assure that excessive erosion or damage has not occurred.
- b) Quarterly a complete inspection of the site will be conducted by Proteco using the checklist shown in Table 7.1. All repairs will be made as necessary.

### **7.5.3 Security Control Devices**

The signs and fence will be monitored for damage monthly during post closure care. Signs and fencing will be repaired or replaced as needed. The gates will be kept locked at all times. Additional security measures will be implemented if there are signs of intrusion.

### **7.5.4 Erosion Damage and Cover Settlement, Subsidence, and Displacement**

Permanent collection channels around the perimeter of the waste units will direct surface water flow into sediment basins and the sediment trap to control run-off and prevent erosion. After construction is complete and the surface armor is installed, permanent collection channels, sediment basins, and the sediment trap will be maintained. The permanent riprap lined channels will direct surface run-off and subsurface run-off from the lateral drainage layer away from the waste units and into the surface water drainage system surrounding the waste units. The collection channels, sediment basins, and sediment traps will be maintained by Proteco throughout the post closure period.

Cover erosion of 1 ton/acre/year was predicted using the United States Department of Agriculture Universal Soil Loss Equation. This rate of soil loss is less than the maximum allowance of 2 tons/acre/year. Therefore, the slope of the closure cover will minimize erosion of the landfill surface. The calculations are included in Appendix D of the Design Report.

The RCRA closure cover will be inspected monthly and after rainfall events of 2 inches in an 8 hour period or greater throughout the post closure care of 30 years. The inspector will look for evidence of settlement, subsidence, or displacement; drainage and ponding of surface water; damaged vegetation; presence of undesirable vegetation; and erosion.

Areas of minor erosion on the closure cover will be backfilled or regraded as necessary in accordance with this Closure and Post Closure Plan. Areas of significant erosion will be

repaired by replacing appropriate layers of the RCRA closure cover necessary. Repaired areas will be monitored.

#### **7.5.5 Integrity of Run-on and Run-off Control Measures**

The topography of the waste units are such that run-on of precipitation is not a concern. The site will be graded to allow relatively uniform run-off from the waste units' area. Run-off from the closure cover will flow into collection channels, sediment basins, and a sediment trap before exiting into the streams surrounding the facility. The erosion control features will be inspected quarterly. Any erosion problems will be corrected promptly. Existing erosion controls will be repaired or improved as necessary. Additional erosion control measures will be installed if the existing measures prove to be inadequate.

#### **7.5.6 Gas Venting System**

The venting system will be inspected quarterly for damage to the vents. During post closure care, vents will be replaced as necessary. If damage is severe, the entire vent may need to be replaced.

#### **7.5.7 Benchmarks**

Upon completion of the RCRA closure cover, ten permanent benchmarks will be established at the site. The benchmarks will be inspected monthly for obvious damage, and to determine if they are still present. A certified land surveyor registered in Puerto Rico will verify the elevations of the benchmarks annually. Benchmarks will be monitored throughout post closure care.

### **7.6 POST CLOSURE NOTICES**

Within 60 days after certification of closure of the waste units, Proteco will record a notation in accordance with the local law on the deed or any other instrument that is examined during a title search to the waste units' property that will in perpetuity notify any potential purchaser of the property's condition:

- The land has been used to dispose of hazardous wastes.
- Its use is restricted under 40 CFR 264 Subpart G.
- The survey plat and record of the type, location, and quantity of hazardous wastes disposed of within the waste units have been filed with the local government and with the USEPA Director.

- Submit a signed certification that Proteco recorded the above listed notations including a copy of the document in which the notation has been placed to the USEPA Director.

No later than 60 days after the completion of the established post closure care period for the waste units, Proteco shall submit to the USEPA Director by registered mail a certification that the post closure care period for the closed disposal area was implemented in accordance with the specifications in the approved post closure plan. The certification shall be signed by Proteco and an independent professional engineer registered in Puerto Rico. Documentation supporting the independent Puerto Rico professional engineer's certification shall be furnished to the USEPA Director upon request until he or she releases Proteco from the financial assurance requirements for post closure care under "Cost estimate for post closure care" (40 CFR 264.144).

#### 7.7 POST CLOSURE USES

No other uses are planned for the waste units property during the post closure period.

#### 7.8 TRAINING

Proteco will use experienced personnel for site inspections and maintenance programs. Any major problems arising such as gas migration problems will be immediately referred to a registered professional engineer. In general, materials and equipment needed for various repairs will be dependent upon the nature and extent of the repair. Materials and equipment will be consistent with those considered standard for the construction industry and consistent with the Construction Specifications.

## 8.0 CLOSURE AND POST CLOSURE COST ESTIMATE

---

The Closure/Post Closure Cost Estimates to be provided at a later date.

## 9.0 REFERENCES CITED

---

- Bagchi, A., (1990), *Design, Construction and Monitoring of Sanitary Landfill*, John Wiley and Sons.
- Cadwaller, M., (1986), *Landfill Closures Using HDPE Membranes, Gundle Lining Systems*.
- Corbit, R. A. (1990), *Standard Handbook of Environmental Engineering*, McGraw-Hill, Inc.
- Knipshield, F. W., (1985), "Material Selection and Dimensioning of Geomembranes for Groundwater Protection," *Waste and Refuse*, Vol. 22.
- Koerner, Robert M. (1986) *Designing with Geosynthetics* Prentice-Hall, Englewood Cliffs, New Jersey.
- Koutsourais, M., (1990), *Proceedings of The 4th GRI Seminar, Geosynthetics, Interface Friction and New Developments*, Geosynthetics Research Institute.
- Tchobanoglous, G., Theisen, H., and Samuel Vugul (1993) *Integrated Solid Waste Management*, McGraw-Hill, Hightstown, New Jersey.
- USEPA, May (1991) **Seminar Publication** - *Design and Construction of RCRA/CERCLA Final Covers* EPA/625/4-91/025 Office of Research and Development, Washington, D.C.
- USEPA, August (1989) **Seminar Publication** - *Requirements for Hazardous Waste Landfill Design, Construction, and Closure* EPA/625/4-89/022 Office of Research and Development, Washington, D.C.
- USEPA, July (1989) **Technical Guidance Document**: *Final Covers on Hazardous Waste Landfills and Surface Impoundments* EPA 530-SW-89-047 Office of Solid Waste and Emergency Response, Washington, D.C.
- USEPA, October (1986) **Technical Guidance Document**: *Construction Quality Assurance for Hazardous Waste Land Disposal Facilities* EPA 530-SW-86-031 Office of Solid Waste and Emergency Response, Washington, D.C.
- USEPA, May (1987) *Design, Construction and Maintenance of Cover Systems For Hazardous Waste* EPA/600/2-87/039 Office of Research and Development, Washington, D.C.

Richardson, G. and Koerner, R., December (1987) *Geosynthetic Design Guidance for Hazardous Waste Landfill Cells and Surface Impoundments* EPA/600/2-87/097 Office of Research and Development, Washington, D.C.

Wanielista, M., (1990), *Hydrology and Water Quality Control*, John Wiley and Sons.

CORRECTIVE ACTION MANAGEMENT UNIT PROPOSAL  
FOR  
WASTE UNITS 4, 7, 9, AND 15  
PROTECCION TECNICA ECOLOGICA, INC.

Submitted to:

Proteccion Tecnica Ecologica, Inc.  
Carr. 385 KM 3.5  
Penuelas, PR 00624

Submitted by:

OHM Remediation Services Corp.  
5335 Triangle Parkway, Suite 450  
Norcross, GA 30092

OHM Project No. 16139

September 1996

## TABLE OF CONTENTS

1.0	INTRODUCTION .....	1-1
	Site Description .....	1-1
2.0	WASTE INVENTORY .....	2-1
2.1	Waste Unit 4 .....	2-1
2.2	Waste Unit 7 .....	2-1
2.3	Waste Unit 9 .....	2-2
2.4	Waste Unit 15 .....	2-2
3.0	CAMU DESIGNATION AND REMEDIAL APPROACH .....	3-1
3.1	CAMU Designation .....	3-1
3.2	Remedial Approach .....	3-1
	3.2.1 Chemical Fixation and Stabilization (CFS) .....	3-2
	3.2.2 Waste Cell .....	3-3
	3.2.3 RCRA Cap .....	3-3
3.3	Waste Unit 15 .....	3-3
4.0	CORRECTIVE ACTION GOALS .....	4-1
5.0	BASELINE SAMPLE AND TREATABILITY STUDY .....	5-1
5.1	Baseline Sample .....	5-1
5.2	Treatability Study .....	5-2
6.0	REMEDIAL DESIGN .....	6-1
6.1	CFS Process Description and Operation .....	6-1
6.2	Confirmatory Sampling and Analysis .....	6-4
	6.2.1 Waste Unit Excavations .....	6-4
	6.2.2 Treated Waste .....	6-4
6.3	Containment and Capping of Treated Waste .....	6-5
	6.3.1 Design Volume of Waste Cell .....	6-5
	6.3.2 Excavation and Grading of Waste Cell .....	6-6
	6.3.3 Waste Cell Construction .....	6-7
	6.3.3.1 Waste Cell Liner and Drainage Layer .....	6-7
	6.3.3.2 Placement of Treated Waste into Waste Cell .....	6-8
	6.3.4 RCRA Cap .....	6-9

### TABLES

Table 1	Closure Performance Parameters and RBC Standards
Table 2	Unconfined Compressive Strength Test Results
Table 3	Estimated Detection Limits for Semi-volatile Constituents

## TABLE OF CONTENTS - CONTINUED

---

### FIGURES

Figure 1	Site Plan
Figure 2	CAMU Limits
Figure 3	CFS Process Flow Diagram
Figure 4	Proposed Site Layout for CFS Unit
Figure 5	Base of Waste Cell Grading Plan - Option 1
Figure 6	Base of Waste Cell Grading Plan - Option 2
Figure 7	Final Grades for Waste Cell
Figure 8	Construction Details
Figure 9	Cross-Section of A-A' and B-B'

### APPENDICES

Appendix A	Bibliography
Appendix B	Baseline Analytical Results
Appendix C	Treatability Study
Appendix D	Waste Cell Volume Calculations

## 1.0 INTRODUCTION

---

Resources Management, Inc. d/b/a PROTECO owns and operates a waste disposal facility in Penuelas, Puerto Rico and is permanently closing in place Waste Units 1, 2, 3, 5, 7, 9, 10, 11, 12, 13, 16, and 17 through the use of a RCRA Closure cap. Design drawings and specifications (Closure Plan Package) for the closure of these units have been prepared and were submitted to the United States Environmental Protection Agency (USEPA), Region II in November 1995. Comments were received from the USEPA in July, 1996. Further amendments are included in this submittal. The Closure Plan Package (CPP) includes construction drawings, construction specifications, construction quality assurance plan, closure/post closure care plan, and a design report.

Closure requirements for Waste Units 4, 7, 9, and 15 are presented in this Corrective Action Management Unit (CAMU) Proposal. Although closure requirements for constructing a RCRA cap over Waste Unit 9 are presented in the CPP, this CAMU specifies the remedial process for treating and disposing of the waste contained in Unit 9 prior to capping. The selected treatment alternative is chemical fixation and stabilization (CFS) and will be performed *ex-situ* in the area designated as the CAMU. Contaminated soil excavated from Units 4, 7, and 9 will be treated by CFS, analyzed, and subsequently placed into a geosynthetic and soil lined waste cell encompassing Waste Unit 9. Remedial activities (stockpiling of soil, CFS treatment process, and disposal) will be conducted and/or located in the area designated as the CAMU. Development of this CAMU is directed by the USEPA in accordance with 40 Code of Federal Regulations (CFR) Parts 260, 264, 265, 268, 270, and 271 - *"Corrective Action Management Units and Temporary Units; Corrective Action Provisions Under Subtitle C."*

### 1.1 SITE DESCRIPTION

PROTECO's facility is located on the southern side of Puerto Rico approximately 2.5 miles southeast of Penuelas, 2 miles north of Tallaboa Bay of the Caribbean Sea, and 1.5 miles east of the Lower Tallaboa River Valley. The site occupies approximately 35 acres and is situated in a small valley ranging in elevation from approximately 260 feet mean sea level (msl) to 400 feet msl. The rugged upland terrain of the valley is steep and supports little vegetation. The steep hills which surround the site are covered year round with xerophilous vegetation and are inhospitable to residential, commercial, or agricultural development.

Typical climatic conditions are semi-arid with approximately 43 inches of annual precipitation, 88 inches of annual evaporation, 79 degrees Fahrenheit annual average temperature, and predominantly easterly winds off the Caribbean Sea. Most precipitation is lost to run-off due to the hard, impermeable surface soil conditions and steep slopes.

The geology beneath the PROTECO facility consists of brown/yellow silty clay from land surface with depths ranging from 25 to 115 feet below surface grade (BSG); gray silty clay beneath the yellow silty clay ranging from 90 to 130 feet deep; and limestone underlying the gray silty clay approximately 60 feet deep.

Three water bearing zones are present beneath the site; 1) alluvial deposits, 2) principal water-bearing zone, and 3) reef limestone. There is little evidence to support the idea that the alluvial deposits are prevalent across the PROTECO facility. The occurrence of the alluvial deposits is best classified as sporadic with limited extent. The water-bearing strata that is consistently present both vertically and horizontally beneath the PROTECO facility is that of the principal water-bearing zone and the reef limestone.

The principal water-bearing zone is present in brown/yellow silty clay and gray silty clay lithologic sequences. Depth to groundwater in the principal water-bearing zone is estimated to be within 50-feet of ground surface.

Under natural conditions, the principal water-bearing zone contains saline water that is non-potable and unsuitable for livestock or irrigation purposes. In addition, the low permeability of the principal water-bearing zone is insufficient to yield an appreciable amount of water for any purpose.

The reef limestone water-bearing zone occurs beneath the gray silty clay sequence and the associated principal water-bearing zone. Depth to groundwater in the reef limestone water-bearing zone is estimated to be 100 to 200 feet BSG. The reef limestone water-bearing zone is less saline than the principal water-bearing zone and may be acceptable for salt-tolerant livestock and irrigation.

## 2.0 WASTE INVENTORY

---

Various waste disposal activities were conducted at the PROTECO facility and in different areas of the site. The four waste units addressed by this CAMU are described below along with the activity that was performed at each unit contaminants, and an estimated quantity of material to be treated. The location of each waste unit and approximate lateral extent of contamination is shown on Figure 1.

### 2.1 WASTE UNIT 4

Waste Unit 4 was an aboveground drum storage facility. Approximately 1,000 drums containing contaminated waste were removed from this unit in the summer of 1992. Subsequent to drum removal activities, PROTECO sampled and analyzed the soils beneath the former drum site. Analytical results indicated that chromium (Cr) and lead (Pb) were present based on a Total Constituents Analysis (TCA). Results of analysis from the Toxic Characteristic Leaching Procedure (TCLP) did not indicate Cr or Pb concentrations in the surrounding soil above the RCRA regulatory thresholds. The soil samples were obtained at depths of 6 inches to 1 foot BSG. Analytical results indicated that contamination beneath the former drum site was limited to shallow depths less than 1 foot BSG. Based on the surface area of Unit 4 (approximately 40,000 ft<sup>2</sup>) and assuming maximum depth of contamination to be 1-foot, it is estimated that 1,500 cubic yards (40,000 ft<sup>3</sup>) of soil from Unit 4 exceeding the corrective action goals will be excavated and treated (by CFS) before placement into a the CAMU cell.

### 2.2 WASTE UNIT 7

Waste Unit 7 was a neutralization impoundment. Records of the waste received in the neutralization impoundment indicate that only RCRA characteristically corrosive waste (D-002 waste code) were treated in this unit. Analytical results from a sampling event conducted in February 1994 indicate that the contents of this unit do not exhibit any characteristic of corrosivity; however, the presence of organic compounds (i.e., volatile organics and semi-volatile organics) were identified within the waste unit.

The estimated lateral extent of contamination occupies a surface area of approximately 6,500 ft<sup>2</sup> and extends vertically to a depth of approximately 11 feet BSG. It is estimated that approximately 2,700 cubic yards (71,500 ft<sup>3</sup>) of waste from unit 7 exceeding the corrective action goals will be excavated and treated (by CFS) before placement into the CAMU cell.

### 2.3 WASTE UNIT 9

Waste Unit 9 was an oil lagoon previously used to collect waste oil. The waste believed to be contained in the unit was approximately 477,700 gallons of water floating on top of approximately 300,000 gallons of oily sludge. In the Fall of 1994, the water phase in the lagoon had evaporated and soil was added and mixed with the remaining sludge to produce a solid matrix. The lagoon was then covered with clean soil to the grades of the surrounding area to prevent water from ponding.

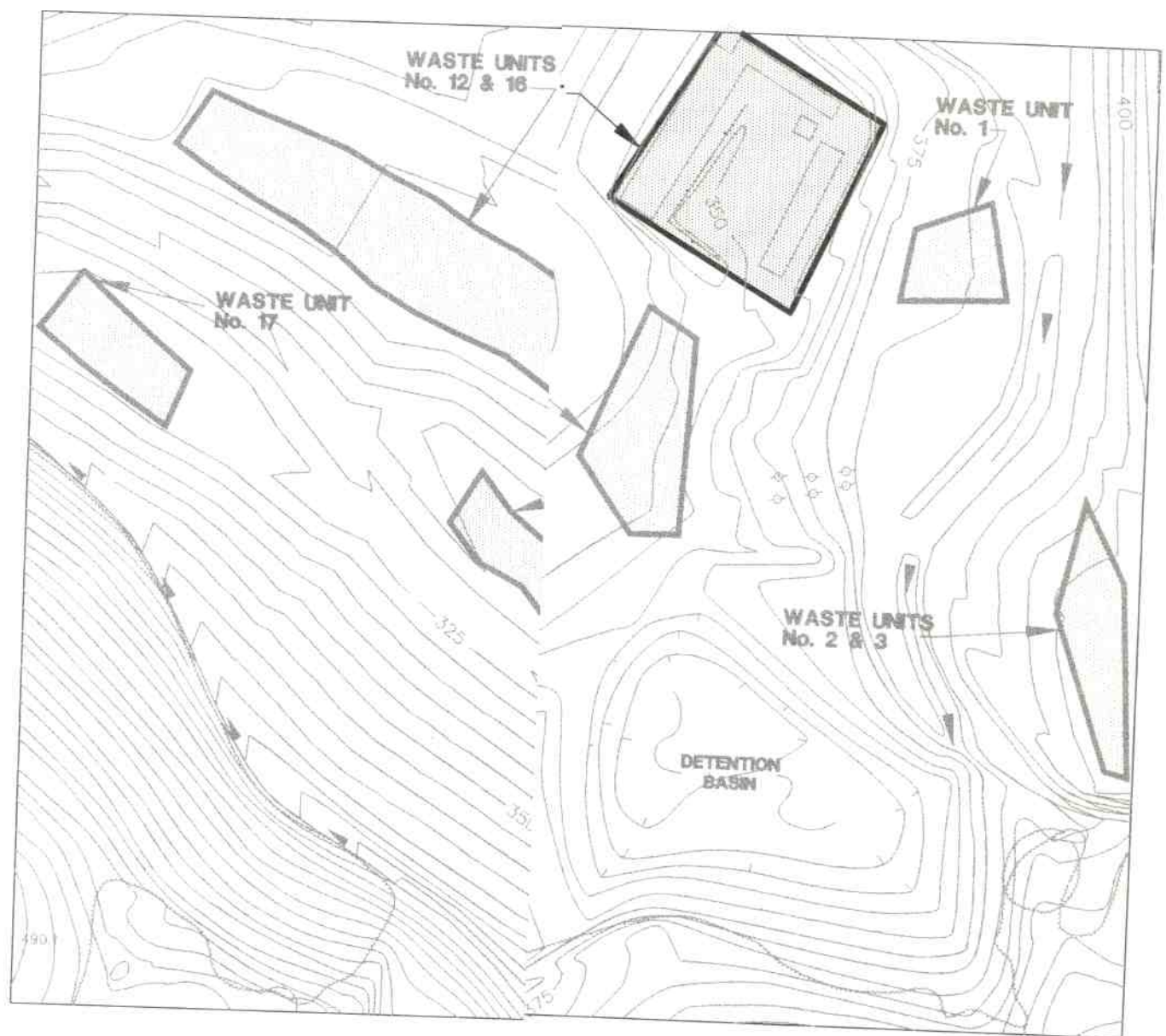
The estimated lateral extent of contamination in Unit 9 occupies a surface area of approximately 18,500 ft<sup>2</sup> and extends vertically to a depth from approximately 8 to 15 feet BSG. It is estimated that approximately 5,300 cubic yards (143,000 ft<sup>3</sup>) of waste from Unit 9 exceeding the corrective action goals will be excavated and treated (CFS) before placement into the CAMU cell.

### 2.4 WASTE UNIT 15

Waste Unit 15 consists of an aboveground storage tank which was previously used to store shampoo that contained lindane. The tank has a capacity of approximately 5,000 gallons and is 6 feet in diameter and 24 feet long. There is approximately 1 to 2 inches of solid residue remaining in the bottom of the tank. Excavation and treatment of soil will not be required for this unit. The tank will be cleaned, cut-up, and disposed of as scrap metal at a recycling facility.

The ground surface adjacent to the tank has not been impacted by storage tank activities; therefore, tank residuals will be the only waste requiring treatment and disposal.

A B C D M N O P



**LEGEND**

LIMITS OF WASTE UNITS

**NOTE:**

CONTOUR INTERVAL IS 5 FEET

**OHM Remediation Services Corp.**

Nacoma, Georgia  
A Subsidiary of OHM Corporation

SUBMITTED: _____	PROJECT MANAGER: _____	DATE: _____
APPROVED: _____	SRL PROJECT ENGINEER: _____	DATE: _____
APPROVED: _____		

AT FULL SCALE (IF NOT 2"=SCALE, ACCORDINGLY)
CADD FILE: CAMU\FIG1.DWG
DRAWN: J. LANGE
DESIGNED: J. ED BUCHI
CHECKED: _____

**FIGURE 1**

**SITE PLAN**

DRAWING NUMBER: <b>1</b>
SHEET NUMBER: 1 of 1

### 3.0 CAMU DESIGNATION AND REMEDIAL APPROACH

---

The purpose of this CAMU is to provide a means for treating and disposing the waste excavated from Units 4, 7, and 9 in a manner that is both economically feasible and that will minimize exposure of the waste to the environment. The treated waste will be placed into a cell lined with a geomembrane and subsequently covered with a RCRA cap. The specifics for the CAMU designation and CFS treatment process are detailed in the paragraphs that follow.

This CAMU provides general design requirements and a description for the CFS process and is not intended to be used as a work plan for implementing the CAMU. A work plan will be prepared prior to implementing the CAMU and submitted to the USEPA for review and approval.

#### 3.1 CAMU DESIGNATION

A CAMU is defined as an area designated for the purpose of managing remediation wastes; thus, this CAMU will be designated as the area required for staging (equipment, soil stockpiles, decontamination area, etc.), processing (treatment unit/vessel), and disposal (waste cell) of the wastes excavated from Units 4, 7, and 9. The area proposed for locating the CAMU include waste unit 9 and the area directly adjacent to and surrounding Unit 9. The proposed limits of the CAMU are shown on Figure 2.

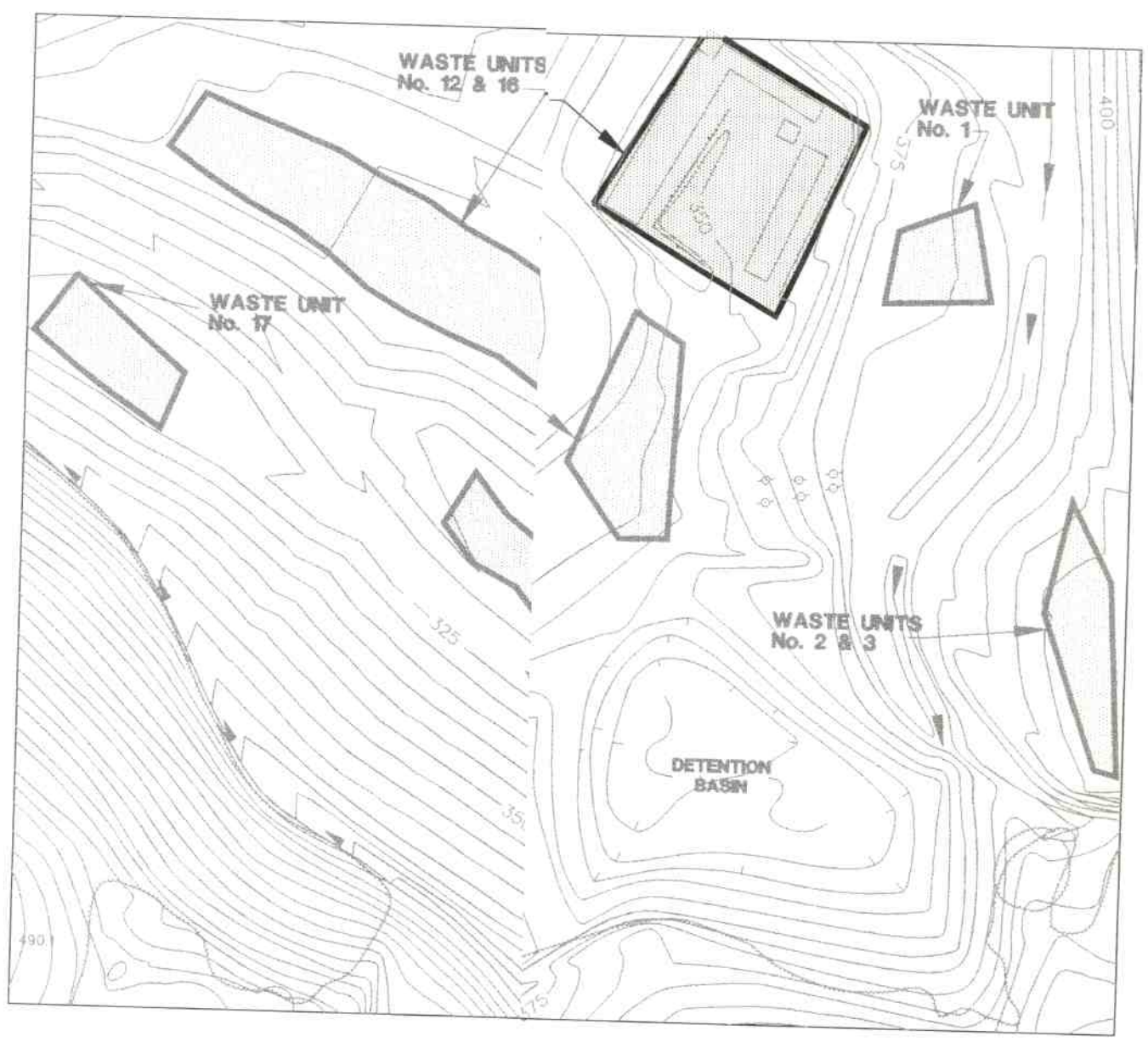
The proposed location for the lined waste cell is where Waste Unit 9 is currently located. This location was selected since Unit 9 will be closed by the installation of a RCRA cap as presented in the CPP. The waste in Unit 9 will be excavated and treated for subsequent disposal in the CAMU cell. Details for grading and constructing the waste cell are presented in Section 6.0 - Remedial Design.

#### 3.2 REMEDIAL APPROACH


The approach for remediating waste from Units 4, 7, and 9 will be conducted in three stages: stabilization, containment, and capping. Waste excavated from Units 4, 7, and 9 will first be treated using CFS. Subsequent to treatment and confirmatory analytical testing, the treated waste will be placed into a lined waste cell and covered with a RCRA cap (as specified in the CPP).

This remedial approach will be a reliable and effective means for immobilizing and containing the waste in that:

A B C D M N O P



**LEGEND**

 LIMITS OF WASTE UNITS

**NOTE:**

CONTOUR INTERVAL IS 5 FEET

**FIGURE 2**  
**CAMU LIMITS**



SUBMITTED: \_\_\_\_\_ DATE: \_\_\_\_\_  
 PROJECT MANAGER: \_\_\_\_\_  
 APPROVED: \_\_\_\_\_ DATE: \_\_\_\_\_

AT FULL SCALE  
 (IF NOT 1"=SCALE ACCORDINGLY)  
 CADD FILE: CAMU/FIG2.DWG  
 DRAWN: J. LANGE  
 DESIGNED: J. ED. BUCHLI

DRAWING NUMBER:  
**2**  
 SHEET NUMBER:  
 1 of 1

- The waste will be solidified and chemically stabilized which will immobilize the contaminants and minimize leaching into the subsurface;
- The treated waste will be placed in a secure composite waste cell that will mitigate the leaching of waste/contaminants into the subsurface; and
- The CAMU cell and treated waste will be covered with a RCRA cap which will minimize the infiltration of surface water and generation of leachate.

### 3.2.1 Chemical Fixation and Stabilization (CFS)

The CFS process is relatively simple in that the excavated waste is screened and mixed with a suitable stabilization reagent and water to create a chemically stable, non-leaching matrix. During this process, physical and chemical reactions occur within the mixture that reduce the mobility of the contaminants and produce a non-leaching matrix. This treatment will be performed to meet the corrective action goals established in Section 4.0.

Many commercially available stabilization reagents are used in the CFS process and include Portland Cement, cement kiln dust, flyash, lime, and/or silicates. Type I Portland Cement is the most commonly used reagent. Both Portland cement and cement kiln dust were tested in the laboratory treatability study discussed in Section 5.0. The raw materials that make-up Portland Cement are lime (calcium), iron, silica, alumina, gypsum, and manganese. When combined with water and the waste, the cement reacts directly with the contaminants (especially inorganic compounds) to produce a high strength calcium silicate. Water is added to the mixture, if not already present in the waste material, to ensure the proper hydration reactions which are necessary for bonding and obtain a workable mixture. The resultant cemented matrix produces a stable compound with a greater compressive strength, and significantly less leaching potential.

Waste from Units 4, 7, and 9 contain low concentrations of various contaminants including heavy metals chromium and lead, volatile organic compounds, and semi-volatile organics. These compounds will be chemically bound or physically entrapped in the solid matrix with the chosen pozzolanic binder. The resulting solid will exhibit lower contaminant solubilities with greatly improved Unconfined Compressive Strength (UCS). The inorganic and organic constituents found in Waste Units 4, 7, and 9 have been previously stabilized successfully in other commercial applications. CFS processes are well established as Best Demonstrated Available Technology (BDAT) for inorganic hazardous metals.

Both solidification (removal of free liquids) and chemical fixation/stabilization processes will occur. Following a brief curing period, the treated material will exhibit a minimum load bearing capacity of greater than or equal to 18 psi to support the overlying RCRA cap. The

recommended mix ratio for treating the waste was determined by a CFS treatability study. A summary of the treatability study is presented in Section 5.2.

### **3.2.2 Waste Cell**

The waste cell will be constructed where Waste Unit 9 is currently located (see Figure 1). Once the waste has been removed from Unit 9, the waste cell will be constructed to the limits, grades and depths specified in Section 6.0.

The treated waste will be placed and contained in the lined waste cell. The liner component of the waste cell will include a 2-foot thick layer of compacted, low permeability ( $<1 \times 10^{-7}$  cm/sec) soil covered with a 60-mil high density polyethylene (HDPE), geomembrane liner. A 12-inch thick sand drainage layer and leachate collection sump will be constructed on top of the geomembrane at the base of the cell.

### **3.2.3 RCRA Cap**

Once all the treated material has been placed into the lined cell, a RCRA cap will be constructed over the cell to confine the waste. The RCRA cap will consist of a 2-foot layer of compacted, low permeability ( $<1 \times 10^{-7}$  cm/sec) soil covered with a geomembrane liner (40-mil HDPE), a 16-ounce geotextile, and a second 2-foot layer of compacted, low permeability soil. The CPP (including construction drawings and specifications) for construction of the cap has been prepared and was submitted to the USEPA, Region II in November 1995. The CPP provides details regarding the cap construction.

## **3.3 WASTE UNIT 15**

Waste Unit 15 consists of a 5,000-gallon aboveground storage tank which previously stored shampoo that contained lindane. This unit will not be included with the waste material being treated or disposed of in the CAMU; however, the cleaning, removal, and disposal of the tank are presented in this CAMU proposal.

The tank will initially be cleaned using a cutter stock material/solution to loosen and remove any remaining sludge and/or residue that remains within the tank. The sludge and rinsate will be vacuumed from the tank and contained in suitable containers (i.e. 55-gallon drums) for subsequent disposal. The tank will then be cleaned with a degreaser solution (i.e., Citri Clean) followed by a rinse with a high pressure steam cleaner to remove any remaining residues. Upon completion of the third rinse, the tank will be considered clean and will be cut up and delivered to a recycling facility as scrap metal. The rinsate generated from these second and third rinses will be vacuumed into suitable containers for subsequent disposal.

Rinsate water generated during cleaning and rinsing of the tank will be transported and disposed of at a permitted treatment facility with the ability to treat the waste. All necessary samples and waste manifests will be obtained and will accompany the waste enroute to the disposal facility.

## 4.0 CORRECTIVE ACTION GOALS

---

Corrective Action goals have been identified for the Waste Units closed as part of the CAMU. Soils from Units 4,7, and 9 will be excavated and "clean closed" as discussed in Section 6.0. Prior to on-site treatment and placement of these materials within the CAMU, Proteco will ensure that all soil/waste exceeding the corrective action goals has been removed.

The proposed corrective action goals for this CAMU are the "EPA Region III Risk-based Concentration Table; Soil Ingestion - Industrial " (Feb. 1995) for volatiles, semi-volatiles, pesticides, and PCBs and "40 CFR, Part 261, Subpart C, Paragraph 261.24, Table 1 - Maximum Concentration of Contaminants for the Toxicity Characteristic" for metals, pesticides, and PCBs.

Table 4.1 provides a comprehensive list of volatile, semi-volatile, pesticide, PCBs, and metal compounds for EPA SW-846 Methods 8240, 8270, 8081, and 6010A. USEPA Region III Risk Based Concentrations (RBCs) for an industrial scenario exist for many of these constituents as presented in the table. Twenty of the volatile and semi-volatile organic compounds listed do not have industrial based RBCs established. They are noted in the table with an "N/A". Where RBCs exist, these levels are proposed as corrective action goals for waste units 4, 7, and 9. Waste will be excavated from these areas to these limits.

For the twenty constituents that do not have RBCs Proteco will establish corrective action goals by obtaining background data. Background samples will be obtained from several locations as outlined in the Sampling and Analysis Plan. Action limits will be established within two standard deviations of background levels. Assuming that no matrix interferences are encountered, Proteco will ensure that the selected subcontract laboratory can attain typical Practical Quantitation Limits (PQLs) for all constituents below the established corrective action goals whether derived from RBCs or background data. PQLs are defined by SW-846 as the "lowest concentration that can be reliably achieved within specified limits of precision and accuracy during routine laboratory operating conditions."

Additionally, leachability-based treatment performance standards are proposed for the treated material following chemical fixation and stabilization. The following WS-846 methods will be performed on the treated material prior to placement in the CAMU cell as stated in the Sampling and Analysis Plan:

- Toxic Characteristic Leading Procedure (TCLP)
  - Extraction Method 1311
  - Volatile Organics Method 8240/60

- Semi-Volatile Organics Method 8270B
- Pesticides/PCBs Method 8081
- Herbicides Method 8150
- Priority Pollutant Metals Method 6010A, 7471

The results will be compared against the established RCRA characteristic levels for organics, pesticides, and metals per 40 CFR, Part 261 Subpart C. Treated material which exhibits levels of contaminants above the RCRA characteristic thresholds will be re-treated until these levels are achieved prior to placement in the CAMU cell.

**Table 1**  
**Closure Performance Parameters and RBC Standards**  
**Compound List, VOC 8260**  
**(concentrations in mg/kg)**

<i>Parameter</i>	<i>CAS Number</i>	<i>Region III RBC</i>	<i>HTL RL</i>	<i>HTL Result</i>
Chloromethane	74-87-3	440	0.020	nd
Bromomethane	74-83-9	2900	0.040	nd
Vinyl chloride	75-05-4	3	0.050	nd
Chloroethane	75-00-3	8.00E+05	0.020	nd
Methylene chloride	75-09-2	760	0.080	nd
Acetone	67-64-1	2.00E+05	0.100	nd
Carbon Disulfide	75-15-0	2.00E+05	0.100	nd
1,1-Dichloroethene	75-35-4	20000	0.040	nd
1,1-Dichloroethane	75-34-3	2.00E+05	0.020	nd
1,2-Dichloroethene	540-59-0	18000	0.100	nd
Chloroform	67-66-3	940	0.100	<0.100
1,2-Dichloroethane	107-06-2	63	0.030	nd
2-Butanone	79-93-3	1.00E+06	0.100	nd
1,1,1-Trichloroethane	71-55-6	72000	0.010	nd
Carbon Tetrachloride	56-23-5	44	0.030	nd
Bromodichloromethane	75-27-4	92	0.030	nd
1,2-Dichloropropane	78-87-5	84	0.010	nd
cis-1,3-Dichloropropene	10061-01-5	N/A	0.030	nd
Trichloroethene	79-01-6	520	0.030	0.030
Dibromochloromethane	124-48-1	68	0.030	nd
1,1,2-Trichloroethane	79-00-5	100	0.010	0.003
Benzene	71-43-2	200	0.050	nd
trans-1,3-Dichloropropene	10061-02-6	N/A	0.010	nd
Bromoform	75-25-2	720	0.060	nd
4-Methyl-2-Pentanone	108-10-1	2.00E+05	0.100	nd
2-Hexanone	591-78-6	N/A	0.010	nd
Tetrachloroethene	127-18-4	110	0.010	0.783
Toluene	108-88-3	4.00E+05	0.050	0.109
1,1,2,2-Tetrachloroethane	79-34-5	2.90E+01	0.050	nd
Chlorobenzene	108-90-7	1.00E+06	0.050	nd
Ethylbenzene	100-41-4	1.00E+06	0.050	nd
Styrene	100-42-5	4.00E+05	0.050	nd
p-Xylene	106-42-3	1.00E+06	0.100	0.339
m-Xylene	108-38-3	1.00E+06	0.100	0.339
o-Xylene	95-47-6	1.00E+06	0.100	0.154
1,2-Dichlorobenzene	95-50-1	2.00E+05	0.020	nd
1,3-Dichlorobenzene	541-73-1	2.00E+05	0.020	nd
1,4-Dichlorobenzene	106-46-7	240	0.020	nd

HTL - High Technology Laboratory, Inc., San Juan Puerto Rico results from baseline sampling of Waste Unit 9 dated 11/17/95; RL is reporting limit

**Table 1**  
**Closure Performance Parameters and RBC Standards**  
**Compound List, SVOC 8270**  
**(concentrations in mg/kg)**

<i>Parameter</i>	<i>CAS Number</i>	<i>Region III RBC</i>	<i>HTL RL</i>	<i>HTL Result</i>
Phenol	108-95-2	1.00E+06	39.5	nd
Bis (2-chloroethyl) ether	111-44-4	N/A	19.2	nd
2-Chlorophenol	95-57-8	1000	19.2	nd
2-Methylphenol	95-48-7	1.00E+05	39.5	nd
Bis (2-chloroisopropyl) ether	108-60-1	N/A	13.2	nd
4-Methylphenol	106-44-5	10000	39.5	nd
N-nitroso-di-n-propylamine	621-64-7	0.82	19.2	nd
Hexachloroethane	67-72-1	410	13.2	nd
Nitrobenzene	98-95-3	1000	19.2	nd
Isophorone	78-59-1	6000	19.2	nd
2-nitrophenol	88-75-5	N/A	19.2	nd
2,4-dimethylphenol	105-6795	41000	19.2	nd
Bis (2-chloroethoxy) methane	111-91-1	N/A	39.5	nd
2,4-dichlorophenol	120-83-2	6100	39.5	nd
1,2,4-trichlorobenzene	120-82-1	20000	13.2	nd
Naphthalene	91-20-3	82000	13.2	nd
4-chloroaniline	106-47-8	N/A	32.9	nd
Hexachlorobutadiene	87-68-3	73	13.2	nd
Parachlorometa cresol	59-50-7	N/A	39.5	nd
2-Methylnaphthalene	91-57-6	N/A	32.9	nd
Hexachlorocyclopentadiene	77-47-4	N/A	13.2	nd
2,4,6-trichlorophenol	88-06-2	520	52.6	nd
2,4,5-trichlorophenol	95-95-4	2.00E+05	32.9	nd
2-chloronaphthalene	91-58-7	2.00E+05	13.2	nd
2-nitroaniline	88-74-4	120	32.9	nd
Dimethyl phthalate	131-11-3	1.00E+06	13.2	nd
Acenaphthylene	208-96-8	N/A	13.2	nd
2,6-Dinitrotoluene	606-20-2	2000	13.2	nd
3-nitroaniline	99-09-2	6100	32.9	nd
Acenaphthene	83-32-9	N/A	13.2	nd
2,4-dinitrophenol	51-28-5	4100	19.7	nd
4-nitrophenol	100-02-7	1.00E+05	32.9	nd
Dibenzofuran	132-64-9	N/A	32.9	nd
2,4-dinitrotoluene	121-14-2	4100	19.7	nd
Diethylphthalate	84-66-2	1.00E+06	19.7	nd
4chlorophyl phenyl ether	7005-72-3	N/A	13.2	nd
Fluorene	86-73-7	82000	13.2	nd
4-nitroaniline	100-01-6	6100	59.2	nd
4,6-dinitro-o-cresol	534-52-1	N/A	19.7	nd
N-nitrosodiphenylamine	86-30-6	1200	13.2	nd

**Table 1**  
**Closure Performance Parameters and RBC Standards**  
**Compound List, SVOC 8270**  
**(concentrations in mg/kg)**

<i>Parameter</i>	<i>CAS Number</i>	<i>Region III RBC</i>	<i>HTL RL</i>	<i>HTL Result</i>
4-bromophenyl phenyl ether	101-55-3	1.00E+05	13.2	nd
Hexachlorobenzene	118-74-1	3.6	32.9	nd
Pentachlorophenol	87-86-5	48	19.7	nd
Phenanthrene	85-01-8	N/A	13.2	nd
Anthracene	120-12-7	6.00E+05	13.2	nd
Carbazole	86-74-8	N/A	32.9	nd
Di-n-butyl phthalate	84-74-2	2.00E+05	13.2	nd
Fluoranthene	206-44-0	82000	13.2	nd
Pyrene	129-0-0	6100	13.2	nd
Butyl benzyl phthalate	85-68-7	4.00E+05	13.2	nd
3,3'-dichlorobenzidine	91-94-1	13	13.2	nd
Benzo(a)anthracene	56-55-5	7.8	13.2	nd
Chrysene	218-01-9	780	13.2	nd
Bis (2-ethylhexyl) phthalate	117-81-7	N/A	13.2	nd
Di-n-octyl phthalate	117-84-0	41000	13.2	nd
Benzo(b)fluoranthene	205-99-2	7.8	13.2	nd
Benzo(k)fluoranthene	207-08-9	78	13.2	nd
Benzo(a)pyrene	50-32-8	0.78	13.2	nd
Ineno(1,2,3-cd)pyrene	193-39-5	7.8	13.2	nd
Dibenzo(a,h)anthracene	53-70-3	0.78	13.2	nd
Benzo(ghi)perylene	191-24-2	N/A	13.2	nd

**Table 1**  
**Closure Performance Parameters and RBC Standards**  
**TAL Metals, 6010A**  
**(concentrations in mg/kg)**

<i>PARAMETER</i>	<i>CAS NUMBER</i>	<i>REGION III RBC</i>	<i>HTL RL</i>	<i>HTL RESULT</i>
Aluminum	7429-90-5	N/A	0.011	nd
Antimony	7440-36-0	820	0.001	nd
Arsenic	7440-38-2	610	0.01	nd
Barium	7440-39-3	100000	0.001	nd
Beryllium	7440-41-7	1.3	0.001	nd
Cadmium	7440-43-9	1000	0.001	nd
Calcium	7440-70-2	N/A	0.011	789
Chromium	7440-47-3	N/A	0.001	nd
Cobalt	7440-48-4	100000	0.001	nd
Copper	7440-50-8	82000	0.007	nd
Iron	7439-89-6	600000	0.001	2.63
Lead	7439-92-1	N/A	0.005	nd
Magnesium	7439-95-4	N/A	0.003	25.3
Manganese	7439-96-5	47000	0.001	1.25
Mercury	7439-97-6	610	0.002	nd
Nickel	7440-02-0	41000	0.001	0.837
Potassium	7440-09-7	N/A	0.006	18.7
Selenium	7782-49-2	10000	0.013	nd
Silver	7440-22-4	10000	0.001	nd
Sodium	7440-23-5	N/A	0.061	nd
Thallium	7440-28-0	No RBC	0.023	nd
Vanadium	7440-62-2	14000	0.001	0.059
Zinc	7440-66-6	600000	0.009	0.205

**Table 1**  
**Closure Performance Parameters and RBC Standards**  
**Compound List pest/PCB**  
**8081 concentrations in mg/kg ▼**

PARAMETER	CAS NUMBER	REGION III RBC	HTL RL	HTL RESULT
Alpha-BHC	319-84-6	0.91	19.7	nd
Beta-BHC	319-85-7	3.2	19.7	nd
Delta-BHC	319-86-8	N/A	19.7	nd
Gamma-BHC (Lindane)	58-89-9	4.4	19.7	nd
Heptachlor	76-44-8	1.3	19.7	nd
Aldrin	309-00-2	0.34	19.7	nd
Heptachlor epoxide	1024-57-3	0.63	19.7	nd
Alpha-Endosulfan	959-98-8	N/A	39.5	nd
Dieldrin	60-57-1	0.36	39.5	nd
4,4-DDE	72-55-9	17	39.5	nd
Endrin	72-20-8	610	39.5	nd
Beta-Endosulfan	33212-65-9	N/A	39.5	nd
4,4-DDT	50-29-3	17	13.2	nd
Methoxychlor	72-43-5	10000	13.2	nd
Endrin Ketone	53494-70-5	N/A	13.2	nd
Endrin aldehyde	7421-93-4	N/A	13.2	nd
Alpha-Chlordane	5103-71-9	N/A	32.9	nd
Gamma-Chlordane	5103-74-2	N/A	32.9	nd
Toxaphene	8001-35-2	5.2	32.9	nd
PCB-1016	12674-11-2	N/A	32.9	nd
PCB-1221	11104-28-2	N/A	32.9	nd
PCB-1232	11141-16-5	N/A	32.9	nd
PCB-1242	53469-21-9	N/A	32.9	nd
PCB-1248	12672-29-6	N/A	32.9	nd
PCB-1254	11097-69-1	N/A	32.9	nd
PCB-1260	11096-82-5	N/A	32.9	nd

## 5.0 BASELINE SAMPLE AND TREATABILITY STUDY

---

A baseline sample and treatability sample were obtained from Waste Unit 9 in order to evaluate the effectiveness of the proposed CFS process. The samples were collected from a composite sample obtained from six separate test pit excavations at varying depths within Unit 9. The samples were composited such that a "worst case" sample (i.e. highest concentrations) would be obtained for the treatability study. The composite sample was split into two 5-gallon containers; one was sent to OHM's treatability laboratory in Findlay, Ohio and the second container was sent to High Technology Laboratory, Inc. (HTL) in San Juan, Puerto Rico for baseline sampling. Each sample was analyzed for the following constituents:

### *Total Constituent Analysis (TCA)*

Volatile Organics	SW-846 Method 8240/60
Semi-volatile Organics	SW-846 Method 8270 B
Pesticides/PCBs	SW-846 Method 8081
Priority Pollutant Metals	SW-846 Method 6010 A, 7471

### *Toxicity Characteristic Leaching Procedure (TCLP)*

Extraction Method	SW-846 Method 1311
Volatile Organics	SW-846 Method 8240/60
Semi-volatile Organics	SW-846 Method 8270 B
Pesticides/PCBs	SW-846 Method 8081
Toxicity Characteristic Constituents	SW-846 Method 6010 A

Results of the baseline sample analysis and a summary of the treatability study are presented in the paragraphs below.

### 5.1 BASELINE SAMPLE

The baseline sample was submitted to HTL in San Juan, Puerto Rico and analyzed for the constituents outlined above. Analytical results indicate that volatile organic constituents were not detected in excess of the RBC values. The following semi-volatile organics constituents had detection limits in excess of the RBC values; however, these constituents were not detected in concentrations above the detection limits.

Bis(2-chloroethyl)ether	N-Nitrosodi-n-propylamine
Hexachlorobenzene	3,3-Dichlorobenzene
Benzo(a)anthracene	Benzo(b)fluoranthene
Benzo(a)pyrene	Indeno(1,2,3-cd)pyrene
Dibenzo(a,h)anthracene	

Analytical results for the remaining semi-volatile constituents indicate that concentrations in excess of the RBCs were not detected.

Analytical results for pesticides and PCBs indicate that Heptachlor, Aldrin, Heptachlor epoxide, Dieldrin, 4,4-DDE, Endrin, 4,4-DDT, Chlordane, and Toxaphene each had detection limits greater than the RBC and/or the Toxicity Characteristic values. As with the semi-volatile organics, these constituents were not detected in concentrations above the detection limits. Analytical results for the remaining pesticides constituents and PCBs indicate that concentrations in excess of the RBCs as corrective action goals were not detected.

For the RCRA toxicity characteristic constituents (metals), analytical results indicate that concentrations in excess of Toxicity Characteristic values were not detected. A complete summary and report of the analytical data for the baseline sample analysis is provided in Appendix B.

## 5.2 TREATABILITY STUDY

A sample for the treatability study was prepared at OHM's laboratory in Findlay, Ohio. Upon receipt in the treatability laboratory, the waste sample was mixed with Portland Cement and cement kiln dust at reagent to waste ratios of 0.05 and 0.10 (total of four test samples). The treatability samples were allowed to cure for seven days prior to being subjected to unconfined compressive strength (UCS) testing and analytical testing. Results of the UCS tests are presented in Table 2 below:

**Table 2**  
**Unconfined Compressive Strength Test Results**

Treatability Sample No.	Portland Cement Mix Ratio	Cement Kiln Dust Mix Ratio	UCS (psi)
1	0.05	NA	66.7
2	0.1	NA	68.8
3	NA	0.05	72.2
4	NA	0.1	104

Assuming that the soil used in the RCRA cap and the treated waste (compacted to 90 percent standard proctor maximum dry density) have a unit weight of 100 pounds per cubic feet, and 26 feet of overburden (22 feet treated waste and 4 feet RCRA cap), the overburden pressure at the base of the waste cell is calculated to be approximately 18 psi. Laboratory results of the treatability samples indicate that the lowest result for the UCS test is 66.7 psi which is much greater than the overburden pressure of 18 psi. Thus, the

design mix ratios using either Portland cement or cement kiln dust prepared in the treatability study will provide sufficient bearing capacity to withstand the overburden pressures of the treated waste and RCRA cap.

Subsequent to curing and UCS tests, treatability Sample No. 1 (0.05 - Portland Cement to waste ratio) was submitted to OHM's analytical laboratory in Findlay, Ohio for analysis of the constituents previously outlined in this section.

Analytical results for volatile organics reported concentrations of Acrylonitrile (<30.3 mg/kg) and Vinyl Chloride (<12.2 mg/kg) which exceed the RBC values of 11.0 mg/kg and 3.0 mg/kg, respectively. Since the concentrations for these two constituents were reported as being within the detection limits, the laboratory was requested to re-evaluate these constituents to determine the concentrations of the reportable limits detected. The original results reported were based on a quantitation limit which were multiplied by a dilution factor that was applied to the sample due to matrix interferences and/or high target analyte concentrations.

A PQL is defined by the SW-846 as "the lowest concentration that can be reliably achieved within specified limits of precision and accuracy during routine laboratory operating conditions." The PQL is generally five to ten times the Method Detection Limit (MDL) and is provided in the methods as guidance and may not always be achievable. An MDL is defined in SW-846 as "the minimum concentration of a substance that can be measured and reported with 99% confidence that the analyte concentration is greater than zero and is determined from analysis of a sample in a given matrix type containing the analyte." The MDL is a statistically generated number based on seven replicates which contain the analyte(s) of interest at a level that is three to five times the estimated MDL.

A PQL for Acrylonitrile and Vinyl Chloride was determined based on the MDLs generated by the laboratory multiplied by the dilution factor that was applied to the sample. The PQL for these two constituents were calculated to be <3.2 mg/kg for Acrylonitrile and <1.7 mg/kg for Vinyl Chloride which are below the RBC values. Concentrations in excess of the RBCs were not identified in the other volatile organic constituents.

Analytical results for semi-volatile organics reported six constituents with detection limits exceeding the RBCs. These constituents were re-evaluated in the same manner as the volatile organic constituents detailed above. The six semi-volatile constituents, RBC values, original analytical result, and the calculated PQL are presented in Table 3 below.

**Table 3 – Estimated Detection Limits for Semi-volatile Constituents**

Parameter	RBC (mg/kg)	Original Reported Results (mg/kg)	PQL (mg/kg)
Benzidine	0.025	<4.0	<1.1
Benzo(a)pyrene	0.78	<4.0	<1.1
Benzo(a)pyrene	0.78	<4.0	<1.0
Hexachlorobenzene	3.6	<4.0	<0.50
N-Nitrosodiethylamine	0.038	<4.0	<0.40
N-Nitrosodi-n-propylamine	0.82	<4.0	<0.60

Analytical results indicate the PQLs for Hexachlorobenzene and N-Nitrosodi-n-propylamine are below the RBCs. Results for Benzidine, Benzo(a)pyrene, Benzo(a)pyrene, and N-Nitrosodiethylamine are inconclusive since the PQLs could be less than the RBCs. Concentrations in excess of the RBCs were not identified in the other semi-volatile organic constituents.

For pesticides, PCBs, and the toxicity characteristics constituents (metals), analytical results indicate that concentrations in excess of the RBCs and Toxicity Characteristic values were not detected. A complete summary including analytical data and results of the treatability study are provided in a report in Appendix C.

Results of the baseline sample analysis and the treatability study indicate that stabilization (CFS) of the waste from units 4,7, and 9 will effectively immobilize the contaminants of concern. Analytical results of the treatability study did not indicate concentrations of volatile or semi-volatile organics, pesticides, or metals in excess of the proposed corrective action goals. Furthermore, placement of the treated waste into a geosynthetic liner waste cell and subsequently covering the cell with a RCRA cap will isolate the waste from the surrounding environment.

## 6.0 REMEDIAL DESIGN

---

Remedial activities that will be performed on Waste Units 4, 7, and 9 are as follows:

- Excavation of waste and contaminated soil from the three separate waste units
- Treatment of the excavated waste using a CFS treatment process
- Construction of a soil and geosynthetic lined waste cell for the permanent storage of the treated materials
- Construction of composite RCRA cap over the CAMU cell upon placement of all treated waste

These activities will be performed in accordance with CAMU regulations and will provide a very secure remedial option that is protective of human health and the environment. The following sections describe the treatment of the waste and design of the waste cell.

### 6.1 CFS PROCESS DESCRIPTION AND OPERATION

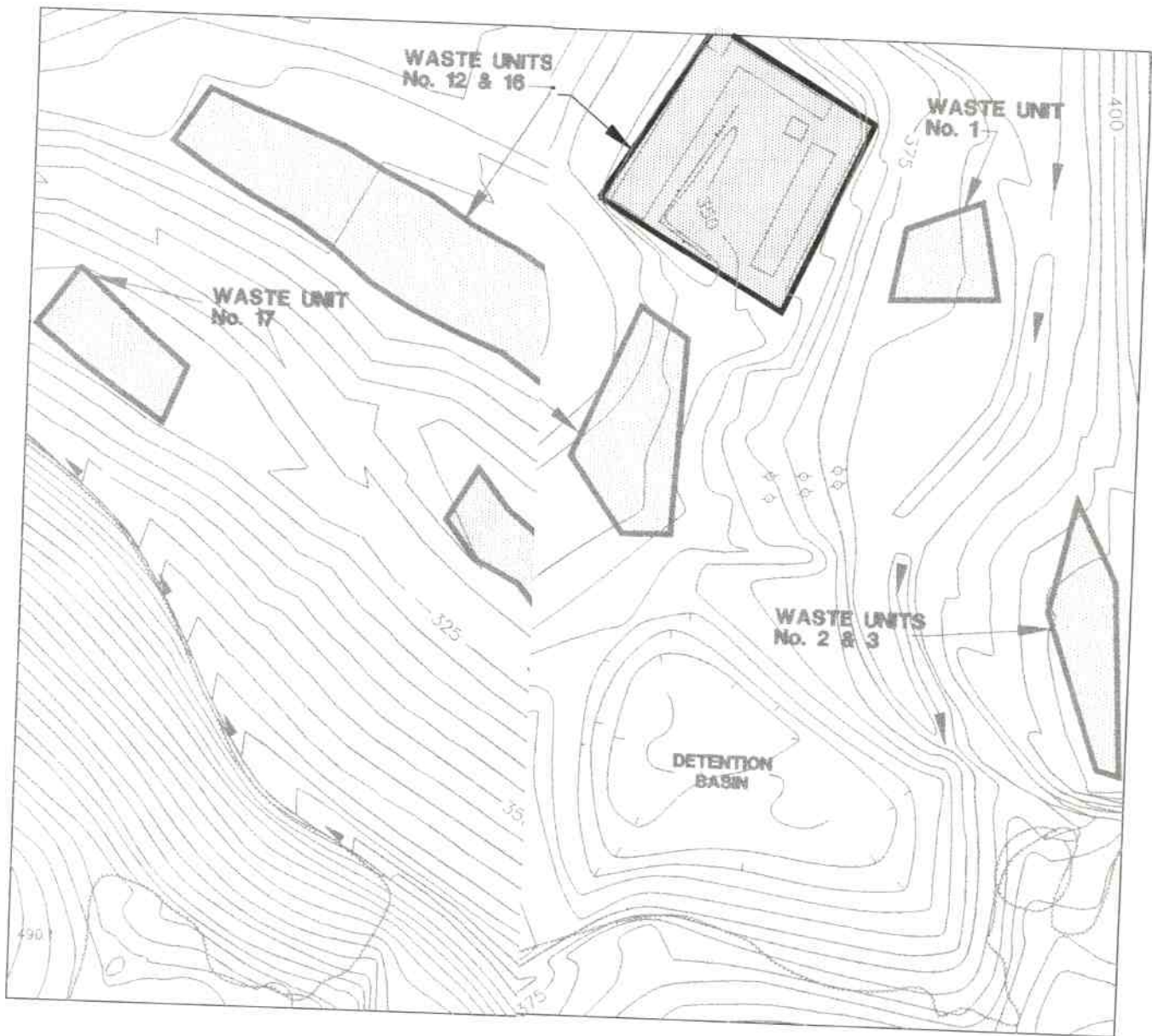
Excavated waste will be processed through a CFS treatment unit using a multi-step process which will include stockpiling, screening, reagent additions, and mixing of the waste material and sampling and analysis. A general process flow diagram for the treatment process is provided as Figure 3.

All activities associated with the CFS operations (i.e. pre-treated and post-treated soil/waste stockpiles, CFS treatment unit, decontamination pad, etc.) will be conducted within the limits of the designated CAMU. A site layout showing the proposed location for the CFS treatment system, stockpiles and decontamination area is provided as Figure 4.

Excavated waste from Units 4, 7, and 9 will be stockpiled in a temporary containment area prior to processing through the CFS treatment unit. The temporary containment area will be synthetically lined and covered with plastic sheeting and encompassed with a 2-foot high berm. Construction of the temporary containment area(s) will comply with all of the applicable and relevant sections of 40 CFR, Part 264, Subpart L, for on-site, temporary remedial activities.

Prior to processing through the treatment unit, the stockpiled waste/soil will be screened using a vibrating screen or grizzly and processed to reduce the particle size of the wastes prior to entering the treatment unit. The screening step will eliminate oversize debris which

A B C D M N O P



**LEGEND**

LIMITS OF WASTE UNITS

**NOTE:**

CONTOUR INTERVAL IS 5 FEET

**OHM Remediation Services Corp.**

Norcross, Georgia  
A Subsidiary of OHM Corporation

SUBMITTED: _____	PROJECT MANAGER: _____	DATE: _____
APPROVED: _____	SAC, PROJECT ENGINEER: _____	DATE: _____
APPROVED: _____	DEPT. MANAGER: _____	DATE: _____

AT FULL SCALE (IF NOT 2"=SCALE ACCORDINGLY)	
CADD FILE: CAMS\FIG4.DWG	
DRAWN: J. LANGE	
DESIGNED: J. ED BUCHLI	
CHECKED: _____	CHECKED: _____

**FIGURE 4**

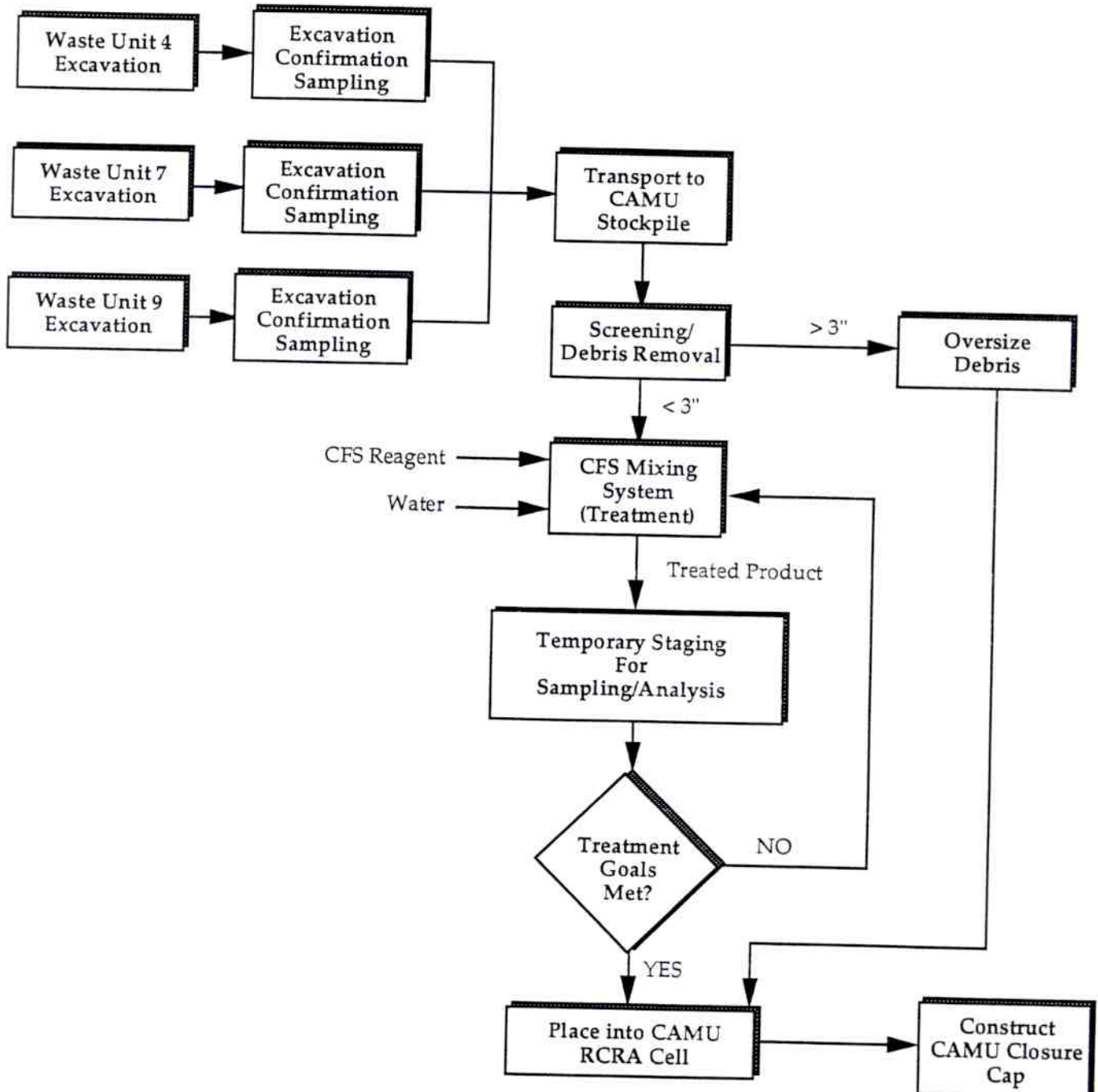
**PROPOSED SITE LAYOUT  
FOR CFS UNIT**

DRAWING NUMBER:
4
SHEET NUMBER:
1 of 1
DATE:

is not suitable for the CFS mixing system. Typically less than 3-inch material will be separated. The waste will then be processed through the treatment unit where the fixation reagent (i.e. Portland Cement, cement kiln dust) and water will be added. The proposed system is a portable SMI batch concrete mixing plant. The system will be capable of batching an estimated 45 cubic yards of material per hour. The system is complete with a mixing chamber, auger type reagent feed bin, and water tank. This CFS unit will provide homogenous mixing of the soil/waste with the reagent and water for optimal treatment efficiency. Further detail will be provided subsequently in the Remedial Action Work Plan to be developed. The treated matrix will be subsequently placed in temporary containment areas to await analytical results.

The temporary containment areas shall be constructed as described in the paragraph above. The treated waste will be stockpiled into separate daily batches and labeled with the batch number and date that the waste was treated. During this temporary staging, samples will be obtained from the treated waste for TCLP analytical testing as detailed in the Sampling and Analysis Plan and in Section 6.2 that follows. Based on results of the analytical data, the treated material will either be placed in the lined CAMU cell or reprocessed through the treatment facility until treatment standards are achieved.

Figure 3  
CFS Process Flow Diagram



## 6.2 CONFIRMATORY SAMPLING AND ANALYSIS

Confirmatory samples will be obtained from each waste unit and the treated waste stream in accordance with attached Sampling and Analysis Plan. This discussion is presented as an overview of the sampling and analysis activities for confirming the limits of excavation and determining successful treatment.

### 6.2.1 Waste Unit Excavations

Each Waste Unit (4,7, and 9) will be sampled when the limits of contamination, as defined herein, are achieved. Each side wall and base of the excavation will be subdivided into quadrants, where a grab sample from each quadrant shall be obtained. One soil sample, a composite of the grab samples, obtained from each wall and base of the excavation, will be submitted for laboratory analysis for the following:

#### *Total Constituent Analysis (TCA)*

Volatile Organics	SW-846 Method 8240/60
Semi-volatile Organics	SW-846 Method 8270B
Pesticides/PCBs	SW-846 Method 8081
Priority Pollutant Metals	SW-846 Method 6010A, 7471

Side walls and/or the base of excavations that exceed 50 feet in length and up to 100 feet will be divided equally and treated as two separate walls/base for composite sampling. Likewise, walls and/or the base of excavations that exceed 100 feet up to 150 feet will be divided equally into three separate walls/base and so forth (i.e., 150 to 200 feet would be equally divided into four segments).

Confirmation analytical results will be compared to the proposed corrective action goals presented in Section 4.0. Should the specified constituents exceed the corrective action goals, then excavation of the waste unit shall continue with subsequent analytical testing until the corrective action goals are achieved.

### 6.2.2 Treated Waste

The treated material will be temporarily stockpiled prior to placement of the treated soil within the CAMU. Samples will be obtained to verify conformance with the corrective action goals. One sample for every 500 cubic yards of treated waste or the amount of waste treated daily, whichever is less, shall be obtained and submitted for laboratory analysis for the following parameters and methods:

#### *Toxicity Characteristic Leaching Procedure (TCLP)*

Extraction Method.	SW-846 Method 1311
Pesticides/PCBs	SW-846 Method 8081
RCRA Metals	SW-846 Method 6010A
Volatile Organics	SW-846 Method 8240/60
Semi-Volatile Organics	SW-846 Method 8270B

Analytical results will be compared to the proposed TCLP-based corrective action goals presented in Section 4.0. Treated waste meeting the proposed corrective action goals will be placed in the lined waste cell. Treated waste that fails to meet the corrective action goals will be reprocessed through the treatment facility.

### **6.3 CONTAINMENT AND CAPPING OF TREATED WASTE**

Once the excavated waste has been treated and tested as described, it will be deposited into a lined waste cell and subsequently covered with a RCRA cap. The components that will comprise the waste cell, listed from the bottom to the top of the RCRA cap, are as follows:

- Low Permeability Soil Layer - 2 feet thick (Optional)
- HDPE Geomembrane - 60 mil thick
- Sand - 1 foot thick
- Treated Waste
- General Fill - Up to 1 foot thick
- Low Permeability Soil Layer - 2 feet thick
- HDPE Geomembrane - 40 mil thick
- Non-woven Geotextile - 16 ounce per square yard
- General Fill - 1.5 feet thick
- Surface Armor - 0.5 feet thick

The lined waste cell will contain the treated waste so that leaching to the groundwater and migration by wind or erosion will be minimized. Capping the waste cell will isolate the waste from human contact and prevent surface water runoff from infiltrating the cap and into the waste. The following paragraphs discuss various aspects of the waste cell such as volume required for storage, the excavation and grading of the waste cell, and the lining system for the bottom and top of the waste cell.

#### **6.3.1 Design Volume of Waste Cell**

The volume of waste to be removed from Waste Units 4, 7, and 9 is estimated to be 40,000 cubic feet, 71,500 cubic feet, and 143,000 cubic feet, respectively, for a total waste volume before treatment of 254,000 cubic feet. The treatability study indicated that an increase of

15 percent by volume could result from the specified reagent mix design. This increases the required air space volume of the waste cell to approximately 293,000 cubic feet.

In addition to the air space volume required there are two soil layers that will be considered in the construction of the waste cell. These units are a 1-foot thick layer of sand on the bottom of the waste cell and a one foot thick layer of clean soil that will cover the treated waste. The approximate volume of the sand layer is 13,000 cubic feet and the approximate volume of the clean cover soil layer is 34,000 cubic feet; thus, the estimated minimum total design volume for the waste cell between the geomembrane liner and the surface of the sub-base grade (in the CPP) is 340,000 cubic feet.

### 6.3.2 Excavation and Grading of Waste Cell

The CAMU cell will be constructed in the area currently occupied by Waste Unit 9. The excavation for Waste Unit 9 will be sampled and analyzed per the SAP to ensure that all waste is removed to achieve the corrective action goals. Once analytical results indicate that the appropriate amount of waste from Unit 9 has been removed, the bottom surface of Unit 9 will be graded to conform to the grades for the base of the waste cell as shown on Figures 5 or 6. The volume of the CAMU cell between the geomembrane liner and the surface of the sub-base grade, based on these grading plans, is approximately 404,500 cubic feet, which exceeds the required minimal volume of 340,000 cubic feet. Volume calculations for the waste cell are presented in Appendix D.

Because of the expected uneven excavation surface to be created during waste removal, it may be necessary to perform additional excavation in some areas and place low permeability soil in other areas. All soil placed to raise the grades to the surface of the low permeability soil layer (base of waste cell) will also meet the same standards and specifications for the placement of the low permeability soil layer for the RCRA cap. Specifications for the low permeability soil layer in the RCRA cap are provided in the CPP.

Geotechnical test results of soils from the site indicate that in-situ soils exhibit a natural hydraulic conductivity less than  $1 \times 10^{-7}$  centimeters per second; thus, it may be possible to omit the construction of the low permeability soil layer. Soil samples shall be collected for laboratory analysis of the hydraulic conductivity from the surface that will compose the low permeability soil layer adjacent to the geomembrane liner. Should the laboratory results indicate that the in-situ soil can achieve the hydraulic conductivity requirements then the low permeability soil layer will not be required to be compacted in place. If the results indicate that adequate hydraulic conductivity is not exhibited in the natural soil, then the area shall be graded to allow the placement of a 2-foot thick low permeability soil layer. Grading plans have been developed for both waste cell scenarios that require and omit the construction of the low permeability soil layer and are provided as Figures 5 and 6. Results

of the hydraulic conductivity tests shall be presented to the USEPA for final affirmation on whether the low permeability soil layer shall be constructed or not.

### 6.3.3 Waste Cell Construction

Once the floor of the waste cell is graded to the required grades and elevations, the soil liner (if required) and geosynthetic liner will be installed. With the liner in place, the drainage layer will be installed followed by disposition of the treated waste into the cell and subsequently covered with soil to the grades shown on Figure 7. These final grades for the CAMU correspond to the sub-base grades for the RCRA cap provided in the CPP. Details for construction of the waste cell liner and drainage layer are as follows.

#### 6.3.3.1 Waste Cell Liner and Drainage Layer

The bottom of the waste cell will consist of three components: low permeability soil layer, geomembrane liner, and a sand drainage layer. The waste cell low permeability soil layer shall be a 2 feet thick layer of material that will have an *in-situ* hydraulic conductivity of  $1 \times 10^{-7}$  cm/s (minimum). The proposed grades for the base of the waste cell are depicted in Figures 5 and 6 and consist of 2:1 slopes starting at elevations varying from 308 feet msl to 319 feet msl and terminate at the floor of the waste cell at 298 feet msl to 296 feet msl. The waste cell floor slopes at approximately 2 percent toward a sump in the middle of the cell.

A 60 mil HDPE geomembrane liner will be placed on top of the low permeability soil layer. This geomembrane will cover the entire surface of the low permeability soil layer and include the cell leachate sump area. To resist the forces of pulling the geomembrane into the waste cell during waste filling, the geomembrane will be terminated in an anchor trench at the crest of the slope around the entire perimeter of the waste cell. Details for the anchor trench are shown on Figure 8.

On top of the geomembrane and across the floor of the waste cell, a 1-foot thick layer of sand having a hydraulic conductivity of no less than  $1 \times 10^{-3}$  cm/s will be placed. The sand layer serves two purposes: to protect the geomembrane when filling the waste cell, and to provide a high permeability layer for draining to the sump any liquids that might enter the waste cell. Sand will cover only the floor of the waste cell (sloped at 2 percent) and will fill the sump. Sand will not be placed on the 2:1 side slopes of the waste unit. Care will be taken to ensure that debris, if encountered, or other materials that can damage the geomembrane are prohibited from being placed along the 2:1 slopes on top of the geomembrane during waste filling operations.

The sump located in the center of the waste cell will collect any liquid that may enter the cell. Previous leachate calculations that were performed on the waste units at the facility by using the Hydraulic Efficiency and Landfill Performance (HELP) computer program. HELP model results indicated that the leachate generation in the waste cell should be

minimal (HELP model calculations are provided in the Design Report of the CPP). This is due in part to the high evapo-transpiration rate, the dry climate, the steep slopes in the area, and the low permeability of the soil. Also, the location of the water table below the bottom of the waste unit and the short time that the excavation shall be open to the atmosphere during filling, factor into the small amount of leachate generation expected. Even though minimal leachate generation is expected, the waste cell has been designed to transport a flow of liquid to the sump.

The sump as shown on the Figure 8 is rectangular in shape with dimensions of 35 feet by 15 feet at the top and 27 feet by 7 feet at the bottom. The side slopes of the sump walls are 2:1. A 1-foot ID HDPE pipe sump riser pipe shall be laid along the side slope and terminate in the bottom of the sump at approximately 296 feet msl. The sump riser pipe will extend up the waste cell side slope and will be anchored at the surface at an elevation of approximately 312 feet msl. When construction of the RCRA cap is complete, a 10 feet by 10 feet concrete pad and a lockable steel pipe will be installed around the sump riser for additional protection. Details for the sump are shown on Figure 8. The level of leachate in the sump will be monitored through the sump riser pipe to determine when evacuation of the sump is necessary.

All aspects for construction of the waste cell liner, including but not limited to grading requirements, compaction requirements, suitable fill material, geomembrane material, etc., shall be in accordance with the construction drawings, construction specifications, and the construction quality assurance plan provided in the CPP.

#### **6.3.3.2 Placement of Treated Waste into Waste Cell**

When construction of the liner system and drainage layer is complete, the treated waste will be placed in the waste cell. Treated waste placed in the cell will be compacted to 90 percent of the Standard Proctor maximum dry density. The molding moisture content of the waste shall be within  $\pm 3$  percent of the optimum moisture content. The addition of water to achieve the molding content shall be minimized in the waste cell to prevent introducing water to the leachate collection system. To protect the geomembrane, select waste which has been identified not to contain any material or substance that will damage the geomembrane shall be placed along the side slopes of waste cell and on top of the geomembrane. When filling, lifts of treated waste shall be placed horizontally across the entire waste unit to prevent unbalanced forces which could either tear the geomembrane or pull it from the anchor trench. Loading equipment will not be allowed to push waste up the side slopes more than 4 feet.

An entrance ramp into the waste cell shall be constructed of treated waste and geogrid in the southern corner of the waste cell (this location has the lowest vertical drop of approximately 12 feet). The geogrid has been included to help carry the load of the waste

on the slope and prevent damage to the geomembrane. A layer of geogrid approximately 40 feet wide shall be placed in the corner of the waste cell running from the top of the cell down the intersection of the two sideslopes to the bottom of the cell. The geogrid shall lie directly on the geomembrane and will be anchored at the top of the waste cell. Once the geogrid is placed and anchored, clean soil will be placed over the geogrid at the crest of the waste cell with the remainder of the geogrid covered with treated waste. Treated waste shall be gradually and evenly pushed over the geogrid with a light weight, low pressure bulldozer until the bottom of the waste cell is reached. When the entrance ramp is complete, heavy equipment (i.e. dump trucks, scrapers) will be allowed to fill the remainder of the excavation with the treated waste to the proposed grades shown on Figure 7 and as specified herein.

#### **6.3.4 RCRA Cap**

Once the treated waste has been placed in the waste cell a RCRA cap will be constructed over the entire waste cell. A detailed discussion of the cap design can be found in the CPP. A 1-foot thick layer of compacted clean general fill will be placed over the treated waste. Final grades of the 1-foot soil layer (final grade for waste cell) will correspond to the sub-base grades in the Construction Drawings of the CPP. This soil layer will serve as a working base for placement of the 2-foot thick low permeability soil layer for the cap. The low permeability soil layer will be compacted to achieve a hydraulic conductivity of  $1 \times 10^{-7}$  cm/s (minimum). A 40-mil HDPE geomembrane will be placed over the low permeability soil layer and across the entire waste unit. The geomembrane liner will be terminated in a shallow anchor trench around the edge of the waste unit.

Above the geomembrane will be a 16-ounce per square yard non-woven geotextile that will serve as a drainage layer and protection for the geomembrane during the placement of overlying soil. The non-woven geotextile will be anchored at the perimeter of the waste unit into a granular layer that will discharge any water draining to the edge of the waste unit.

Above the drainage layer will be an 18-inch thick layer of general fill that will provide additional isolation of the waste and protect the geosynthetic liner system. As a final protective layer a 6-inch layer of surface armor consisting of riprap approximately 6 inches in diameter will cover the waste units.

Details of the RCRA cap including construction drawings, construction specifications, construction quality assurance plan, closure/post closure plan, and the design report are provided in the CPP submitted to the USEPA in November 1995 and amended in this submittal.

**APPENDIX A**  
**BIBLIOGRAPHY**

## BIBLIOGRAPHY

Fred G. Hart and Associates, Inc., Phase IA Hydrogeologic Investigation: Proteccion Tecnica Ecologica, Inc., Ponce, Puerto Rico February 1987.

GeoSyntec Consultants, Final Report, Soil Property and Interface Direct Shear Testing, PROTECO Hazardous Waste Units, Penuelas, Puerto Rico, September 28, 1994.

Hart Engineers, Inc., Phase III Soils Investigation, Proteccion Tecnica Ecologica, Inc., Ponce, Puerto Rico, February 12, 1988.

Hart Engineers, Inc., Unit 9 Investigation Work Plan, Proteccion Tecnica Ecologica, Inc., Ponce, Puerto Rico, September 23, 1988.

OHM Remediation Services Corp., Hydrologic Investigation, PROTECO Landfill Facility, Penuelas, Puerto Rico, September 1994.

OHM Remediation Services Corp., Part II Work Plan, Closure of Hazardous Waste Units, Proteccion Tecnica Ecologica, Penuelas, Puerto Rico, February 1, 1993.

Ressy, Mario S., Hydrologic Conditions at Carbareon Waste Disposal Site, August 1983.

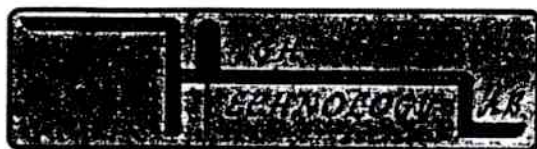
United States Geological Survey, Water Resources of the Tallaboa Valley, Puerto Rico, Water Resources Bulletin 7.

Conner, Jesse R., Chemical Fixation and Solidification of Hazardous Waste, 1990.

United States Environmental Protection Agency, Stabilization/Solidification of CERCLA and RCRA Wastes - Physical Tests, Chemical Testing Procedures, Technology Screening, and Field Activities, EPA/625/6-89/022, May 1989

**APPENDIX B**

**BASELINE ANALYTICAL RESULTS**



**HIGH TECHNOLOGY LABORATORY, INC.**

*Environmental & Analytical Services*

# *Analysis Report*

*for*  
*Proteco*

***Project Description:*** *Volatile and Semivolatile Organics (TCL)*

***Project Number:*** *18146*

***HTL Report Number:*** *95-1727*

***Date of Submittal:*** *December 14, 1995*

***Attention:*** *Mr. Rene Rodríguez*

# Report Certification

Report No. 95-1727  
December 14, 1995

**Customer:** Proteco  
**Address:** P.O. Box 850  
Peñuelas, P.R. 00624-0850  
**Telephone:** 836-2058

**Attention:** Mr. René Rodríguez

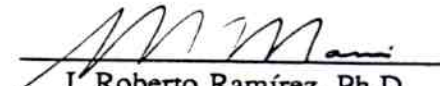
Dear Mr. Rodríguez:

Enclosed please find the report for the analyses you requested. A brief description of the procedures followed by the various analytical divisions of High Technology Laboratory (HTL) are found on the following page. The results for these analyses are reported in the "Result Table".

The quality control data and other supporting documentation pertaining to these analyses, are kept on file at the laboratory for a period of three (3) years. These records will be made available to you upon your request.


The results reported herein were obtained according to the analytical procedures described in our Laboratory SOP's and/or standard methods approved by regulatory agencies. At HTL, our laboratory and administrative procedures are supervised by qualified personnel and are performed following the guidelines of our Quality Assurance Manual.

Quality Assurance Certification by:

  
J. Roberto Ramírez, Ph.D.  
Quality Assurance Director

Quality Control Certification by:



  
Federico Asmar  
Quality Control Manager  
Lic. No. 2471

A 385658

**HIGH TECHNOLOGY LABORATORY, INC.**

P.O. Box 366950, San Juan, PR 00936-6950  
Tel. (809) 793-7288 ; Fax 792-9280

# Summary of Analytical Procedures

## Target Compound List (TCL)

TCL parameters are one hundred and twenty five (125) organic compounds which are classified as follows: thirty three (33) are Volatile Organic Compounds (VOC), sixty four (64) are Semivolatile Organic Compounds (SVOC, these include Base/Neutral/Acids extractables parameters), twenty one (21) are Pesticides and seven (7) are Polychlorinated Biphenyls (PCB's).

All parameters are analyzed by Gas Chromatography/Mass Spectrometry (GC/MS). Identification of each parameter is done by comparison of the retention time and mass spectra of the parameter against a calibration standard analyzed within 12 hours. This calibration standard is injected after passing the tuning and performance check required by the method. After positive identification, quantitation of the parameters is performed by Internal Standard Calibration technique as described in the specific method.

The specific methodology used on each type of compound is as follows:

**Volatile Organic Compounds (VOC):** Sample preparation prior to analysis is performed by EPA method SW-846-5030 (Purge & Trap). In the case of samples with high content of VOC or VOC interferences, an extraction of 4 grams of the sample with 10 mL of methanol is performed. A measured amount of the methanol extract is then added to reagent water and inject into the Purge & Trap system prior to analysis by method SW-846-8260 (GC/MS using capillary column).

**Semivolatile Organic Compounds (SVOC), Pesticides and PCB's:** Sample preparation prior to analysis is performed base on sample matrix: a) Method SW-846-3510 (liquid-liquid extraction) for aqueous samples, b) Method SW-846-3550 (Ultrasonic extraction) for solid samples, c) Method SW-846-3580 (waste dilution) for liquid (non-aqueous) samples and d) sludge samples are filtrated to separate the liquid and solid phases, each phase is treated by the applicable method as described above and the results combined mathematically. After preparation, an organic extract is obtained and analyzed by direct injection in the GC/MS using method SW-846-8270 (GC/MS using capillary column)

**PCB's:** For these parameters a mass selected screening is performed (as described within EPA Method SW-846-8270) for the masses characteristic of each PCB. If the screening is negative, no further analysis is requested by the method.

# Summary of analytical procedures

(Cont.)

## Reporting Limits (RL)

RL are the minimum concentration of a substance that will be reported with 99% confidence that the analyte concentration is greater than zero and is determined from analysis of standards containing the analyte, these are greater or equal to the MDL's (Method Detection Limits) as defined in chapter one (1) of the SW-846 methods. The RL's for each analyte are presented in the result tables, these RL's are not corrected for the dilution or concentration factors and will be referred as  $RL_M$ . The actual RL's for each sample are corrected by the concentration or the dilution factors that came from the sample preparation procedures and will be referred as  $RL_S$ . The following are the corrections that should be applied to each kind of parameters:

VOC: after sample preparation, dilution factors ( $DF_{VOC}$ ) for the samples for VOC analyses are calculated, these factors are found in the Result Tables. The RL for each analyte in the sample ( $RL_S$ ) will be the respective RL in the table ( $RL_M$ ) multiply by the dilution factor for that sample:

$$RL_S = RL_M \times DF_{VOC}$$

SVOC: after sample preparation, concentration factors ( $CF_{SVOC}$ ) for the samples for SVOC analyses are calculated, these factors are found in the Result Tables. The RL for each analyte in the sample ( $RL_S$ ) will be the respective RL in the table ( $RL_M$ ) multiply by the concentration factor and divided by 1000:

$$RL_S = RL_M \times 1000 \times CF_{SVOC}$$

# Volatile Organics Analysis Report

for  
Target Compound List (TCL)

HTL Sample

95-1727-01

Sample ID: Soil Sample  
Sample Matrix: Soil  
Sample wt/vol: 0.582 g  
Dilution Factor: 10  
Level (low/med): Low  
Prep. method: SW-846-5030  
Analysis Method: SW-846-8260

Date Sampled: November 17, 1995  
Sampled by: Client  
Date Received: November 17, 1995  
Date Analyzed: December 1st, 1995  
QC-Batch: 95-145

Parameter	CAS Number	EPA Method of Analysis	RL (ppm)	Amount (ppm)
Chloromethane	74-87-3	SW-846-8260	0.020	nd
Bromomethane	74-83-9	SW-846-8260	0.040	nd
Vinyl chloride	75-01-4	SW-846-8260	0.050	nd
Chloroethane	75-00-3	SW-846-8260	0.020	nd
Methylene chloride	75-09-2	SW-846-8260	0.080	nd
Acetone	67-64-1	SW-846-8260	0.100	nd
Carbon Disulfide	75-15-0	SW-846-8260	0.100	nd
1,1-Dichloroethene	75-35-4	SW-846-8260	0.040	nd
1,1-Dichloroethane	75-34-3	SW-846-8260	0.020	nd
1,2-Dichloroethene (total)	540-59-0	SW-846-8260	0.100	nd
Chloroform	67-66-3	SW-846-8260	0.100	<0.10
1,2-Dichloroethane	107-06-2	SW-846-8260	0.030	nd
2-Butanone	78-93-3	SW-846-8260	0.100	nd
1,1,1-Trichloroethane	71-55-6	SW-846-8260	0.010	nd
Carbon Tetrachloride	56-23-5	SW-846-8260	0.030	nd
Bromodichloromethane	75-27-4	SW-846-8260	0.030	nd
1,2-Dichloropropane	78-87-5	SW-846-8260	0.010	nd
cis-1,3-Dichloropropene	10061-01-5	SW-846-8260	0.010	nd

HIGH TECHNOLOGY LABORATORY, INC.

P.O. Box 366950, San Juan, PR 00936-6950  
Tel. (809) 793-7288 ; Fax 792-9280



Report No. 95-1727

Page 4

***Volatile Organics Analysis Report***  
for  
***Target Compound List (TCL)***

Sample ID: Soil Sample

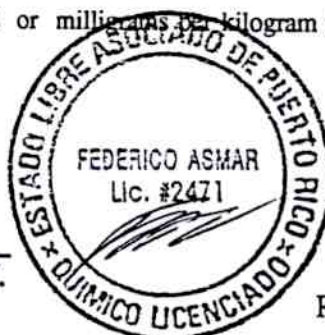
HTL Sample No.95-1727-01

Parameter	CAS Number	EPA Method of Analysis	RL (ppm)	Amount (ppm)
Trichloroethene	79-01-6	SW-846-8260	0.030	0.035
Dibromochloromethane	124-48-1	SW-846-8260	0.030	nd
1,1,2-Trichloroethane	79-00-5	SW-846-8260	0.010	0.003
Benzene	71-43-2	SW-846-8260	0.050	nd
trans-1,3-Dichloropropene	10061-02-6	SW-846-8260	0.010	nd
Bromoform	75-25-2	SW-846-8260	0.060	nd
4-Methyl-2-Pentanone	108-10-1	SW-846-8260	0.100	nd
2-Hexanone	591-78-6	SW-846-8260	0.010	nd
Tetrachloroethene	127-18-4	SW-846-8260	0.010	0.783
Toluene	108-88-3	SW-846-8260	0.050	0.109
1,1,2,2-Tetrachloroethane	79-34-5	SW-846-8260	0.050	nd
Chlorobenzene	108-90-7	SW-846-8260	0.050	nd
Ethylbenzene	100-41-4	SW-846-8260	0.050	nd
Styrene	100-42-5	SW-846-8260	0.050	nd
m & p-xylene	---	SW-846-8260	0.100	0.339
o-xylene	---	SW-846-8260	0.100	0.154
1,2-Dichlorobenzene	95-50-1	SW-846-8260	0.020	nd
1,3-Dichlorobenzene	541-73-1	SW-846-8260	0.020	nd
1,4-Dichlorobenzene	106-46-7	SW-846-8260	0.020	nd

nd = non-detected (if present concentration below detection limit)

RL = Reporting Limit

ppm = Parts Per Million = milligrams per liter (liquids) or milligrams per kilogram (solids)



**HIGH TECHNOLOGY LABORATORY, INC.**

P.O. Box 366950, San Juan, PR 00936-6950

Tel. (809) 793-7288 ; Fax 792-9280

Report No. 95-1727

Page 5

# Semivolatile Organics Analysis Report

for  
Target Compound List (TCL)

HTL Sample

95-1727-01

Sample ID: Soil Sample  
 Sample Matrix: Soil  
 Sample wt/vol: 15.2 g  
 Concent. Factor: 0.152  
 Level (low/med): Low  
 Extr. method: SW-846-3550  
 Analysis Method: SW-846-8270

Date Sampled: November 17, 1995  
 Sampled by: Client  
 Date Received: November 17, 1995  
 Date Extracted: December 4, 1995  
 Date Analyzed: December 8, 1995  
 QC-Batch: 95-064

Parameter	CAS Number	EPA Method of Analysis	RL (ppm)	Amount (ppm)
Phenol	108-95-2	SW-846-8270	39.5	nd
Bis (2-chloroethyl) ether	111-44-4	SW-846-8270	19.2	nd
2-chlorophenol	95-57-8	SW-846-8270	19.2	nd
2-Methylphenol	95-48-7	SW_846-8270	39.5	nd
Bis (2-chloroisopropyl) ether	108-60-1	SW-846-8270	13.2	nd
4-Methylphenol	106-44-5	SW-846-8270	39.5	nd
N-nitroso-di-n-propylamine	621-64-7	SW-846-8270	19.2	nd
Hexachloroethane	67-72-1	SW-846-8270	13.2	nd
Nitrobenzene	98-95-3	SW-846-8270	19.2	nd
Isophorone	78-59-1	SW-846-8270	19.2	nd
2-nitrophenol	88-75-5	SW-846-8270	19.2	nd
2,4-dimethylphenol	105-67-9	SW-846-8270	19.2	nd
Bis (2-chloroethoxy) methane	111-91-1	SW-846-8270	39.5	nd
2,4-dichlorophenol	120-83-2	SW-846-8270	39.5	nd
1,2,4-trichlorobenzene	120-82-1	SW-846-8270	13.2	nd
Naphthalene	91-20-3	SW-846-8270	13.2	nd
4-Chloroaniline	106-47-8	SW-846-8270	32.9	nd

**HIGH TECHNOLOGY LABORATORY, INC.**

P.O. Box 366950, San Juan, PR 00936-6950  
 Tel. (809) 793-7288 ; Fax 792-9280



Report No. 95-1727  
 Page 6

**Semivolatile Organics Analysis Report**  
for  
**Target Compound List (TCL)**

Sample ID: Soil Sample

HTL Sample No. 95-1727-01

Parameter	CAS Number	EPA Method of Analysis	RL (ppm)	Amount (ppm)
Hexachlorobutadiene	87-68-3	SW-846-8270	13.2	nd
Parachlorometa cresol	59-50-7	SW-846-8270	39.5	nd
2-Methylnaphthalene	91-57-6	SW-846-8270	32.9	nd
Hexachlorocyclopentadiene	77-47-4	SW-846-8270	13.2	nd
2,4,6-trichlorophenol	88-06-2	SW-846-8270	52.6	nd
2,4,5-trichlorophenol	95-95-4	SW-846-8270	32.9	nd
2-chloronaphthalene	91-58-7	SW-846-8270	13.2	nd
2-nitroaniline	88-74-4	SW-846-8270	32.9	nd
Dimethyl phthalate	131-11-3	SW-846-8270	13.2	nd
Acenaphthylene	208-96-8	SW-846-8270	13.2	nd
2,6-Dinitrotoluene	606-20-2	SW-846-8270	13.2	nd
3-nitroaniline	99-09-2	SW-846-8270	32.9	nd
Acenaphthene	83-32-9	SW-846-8270	13.2	nd
2,4-dinitrophenol	51-28-5	SW-846-8270	19.7	nd
4-nitrophenol	100-02-7	SW-846-8270	32.9	nd
Dibenzofuran	132-64-9	SW-846-8270	32.9	nd
2,4-dinitrotoluene	121-14-2	SW-846-8270	19.7	nd
Diethylphthalate	84-66-2	SW-846-8270	19.7	nd
4-chlorophenyl phenyl ether	7005-72-3	SW-846-8270	13.2	nd
Fluorene	86-73-7	SW-846-8270	13.2	nd
4-Nitroaniline	100-01-6	SW-846-8270	59.2	nd
4,6-dinitro-o-cresol	534-52-1	SW-846-8270	19.7	nd
N-nitrosodiphenylamine	86-30-6	SW-846-8270	13.2	nd
4-bromophenyl phenyl ether	101-55-3	SW-846-8270	13.2	nd

**HIGH TECHNOLOGY LABORATORY, INC.**

P.O. Box 366950, San Juan, PR 00936-6950

Tel. (809) 793-7288 ; Fax 792-9280



Report No. 95-1727

Page 7

**Semivolatile Organics Analysis Report**  
for  
**Target Compound List (TCL)**

Sample ID: Soil Sample

HTL Sample No. 95-1727-01

Parameter	CAS Number	EPA Method of Analysis	RL (ppm)	Amount (ppm)
Hexachlorobenzene	118-74-1	SW-846-8270	32.9	nd
Pentachlorophenol	87-86-5	SW-846-8270	19.7	nd
Phenanthrene	85-01-8	SW-846-8270	13.2	nd
Anthracene	120-12-7	SW-846-8270	13.2	nd
Carbazole	86-74-8	SW-846-8270	32.9	nd
Di-n-butyl phthalate	84-74-2	SW-846-8270	13.2	nd
Fluoranthene	206-44-0	SW-846-8270	13.2	nd
Pyrene	129-00-0	SW-846-8270	13.2	nd
Butyl benzyl phthalate	85-68-7	SW-846-8270	13.2	nd
3,3'-dichlorobenzidine	91-94-1	SW-846-8270	13.2	nd
Benzo(a)anthracene	56-55-3	SW-846-8270	13.2	nd
Chrysene	218-01-9	SW-846-8270	13.2	nd
Bis (2-ethylhexyl) phthalate	117-81-7	SW-846-8270	13.2	nd
Di-n-octyl phthalate	117-84-0	SW-846-8270	13.2	nd
Benzo(b)fluoranthene	205-99-2	SW-846-8270	13.2	nd
Benzo(k)fluoranthene	207-08-9	SW-846-8270	13.2	nd
Benzo(a)pyrene	50-32-8	SW-846-8270	13.2	nd
Indeno(1,2,3-cd)pyrene	193-39-5	SW-846-8270	13.2	nd
Dibenzo(a,h)anthracene	53-70-3	SW-846-8270	13.2	nd
Benzo(ghi)perylene	191-24-2	SW-846-8270	13.2	nd

nd = non-detected (if present concentration below detection limit)

RL = Reporting Limit

ppm = Parts Per Million = milligrams per liter (liquids) or milligrams per kilogram (solids)



**HIGH TECHNOLOGY LABORATORY, INC.**

P.O. Box 366950, San Juan, PR 00936-6950

Tel. (809) 793-7288 ; Fax 792-9280

Report No. 95-1727

Page 8

# *Pesticides & PCB's Analysis Report*

*for*  
*Target Compound List (TCL)*

HTL Sample

95-1727-01

Sample ID: Soil Sample  
 Sample Matrix: Soil  
 Sample wt/vol: 15.2 g  
 Concent. Factor: 0.152  
 Level (low/med): Low  
 Extr. method: SW-846-3550  
 Analysis Method: SW-846-8270

Date Sampled: November 17, 1995  
 Sampled by: Client  
 Date Received: November 17, 1995  
 Date Extracted: December 4, 1995  
 Date Analyzed: December 8, 1995  
 QC-Batch: 95-064

Parameter	CAS Number	EPA Method of Analysis	RL (ppm)	Amount (ppm)
Alpha-BHC	319-84-6	SW-846-8270	19.7	nd
Beta-BHC	319-85-7	SW-846-8270	19.7	nd
Delta-BHC	319-86-8	SW-846-8270	19.7	nd
Gamma-BHC (Lindane)	58-89-9	SW-846-8270	19.7	nd
Heptachlor	76-44-8	SW-846-8270	19.7	nd
Aldrin	309-00-2	SW-846-8270	19.7	nd
Heptachlor epoxide	1024-57-3	SW-846-8270	19.7	nd
Alpha-Endosulfan	959-98-8	SW-846-8270	39.5	nd
Dieldrin	60-57-1	SW-846-8270	39.5	nd
4,4-DDE	72-55-9	SW-846-8270	39.5	nd
Endrin	72-20-8	SW-846-8270	39.5	nd
Beta-Endosulfan	33212-65-9	SW-846-8270	39.5	nd
4,4-DDT	50-29-3	SW-846-8270	13.2	nd
Methoxychlor	72-43-5	SW-846-8270	13.2	nd
Endrin Ketone	53494-70-5	SW-846-8270	13.2	nd
Endrin aldehyde	7421-93-4	SW-846-8270	13.2	nd
Alpha-Chlordane	5103-71-9	SW-846-8270	32.9	nd

**HIGH TECHNOLOGY LABORATORY, INC.**

P.O. Box 366950, San Juan, PR 00936-6950  
 Tel. (809) 793-7288 ; Fax 792-9280



Report No. 95-1727

Page 9

***Pesticides & PCB's Analysis Report***  
*for*  
***Target Compound List (TCL)***

Sample ID: Soil Sample

HTL Sample No. 95-1727-01

Parameter	CAS Number	EPA Method of Analysis	RL (ppm)	Amount (ppm)
Gamma-Chlordane	5103-74-2	SW-846-8270	32.9	nd
Toxaphene	8001-35-2	SW-846-8270	32.9	nd
PCB-1016	12674-11-2	SW-846-8270	32.9	nd
PCB-1221	11104-28-2	SW-846-8270	32.9	nd
PCB-1232	11141-16-5	SW-846-8270	32.9	nd
PCB-1242	53469-21-9	SW-846-8270	32.9	nd
PCB-1248	12672-29-6	SW-846-8270	32.9	nd
PCB-1254	11097-69-1	SW-846-8270	32.9	nd
PCB-1260	11096-82-5	SW-846-8270	32.9	nd

nd = non-detected (if present concentration below detection limit)

RL = Reporting Limit

ppm = Parts Per Million = milligrams per liter (liquids) or milligrams per kilogram (solids)



***HIGH TECHNOLOGY LABORATORY, INC.***

P.O. Box 366950, San Juan, PR 00936-6950

Tel. (809) 793-7288 ; Fax 792-9280

Report No. 95-1727

Page 10

## *QUALITY CONTROL*

# *Volatile Surrogate Recoveries*

QC Batch Number

95-145

HTL Sample ID	Surrogate % Recoveries			Total Out
	Surr-1	Surr-2	Surr-3	
95-1727-01	54	92	88	1

Parameter	QC Limits (% recovery)	
	Water	Soil
Surr-1 = Dibromofluoromethane	(86-118)	(80-120)
Surr-2 = Toluene-d <sub>8</sub>	(88-110)	(81-117)
Surr-3 = 4-Bromofluorobenzene	(86-115)	(74-121)

\* = Values outside of QC limits

D = System Monitoring Compound diluted out

# *Blanks Report for VOC*

**QC Batch Number**

95-145

**Units:**    ppm

**Method:** 846-8260

Parameter	CAS Number	EPA Method of Analysis	RL (ppm)	Amount Blank (1) (ppm)
Chloromethane	74-87-3	SW-846-8260	0.020	nd
Bromomethane	74-83-9	SW-846-8260	0.040	nd
Vinyl chloride	75-01-4	SW-846-8260	0.050	nd
Chloroethane	75-00-3	SW-846-8260	0.020	nd
Methylene chloride	75-09-2	SW-846-8260	0.080	nd
Acetone	67-64-1	SW-846-8260	0.100	nd
Carbon Disulfide	75-15-0	SW-846-8260	0.100	nd
1,1-Dichloroethene	75-35-4	SW-846-8260	0.040	nd
1,1-Dichloroethane	75-34-3	SW-846-8260	0.020	nd
1,2-Dichloroethene (total)	540-59-0	SW-846-8260	0.100	nd
Chloroform	67-66-3	SW-846-8260	0.100	nd
1,2-Dichloroethane	107-06-2	SW-846-8260	0.030	nd
2-Butanone	78-93-3	SW-846-8260	0.100	nd
1,1,1-Trichloroethane	71-55-6	SW-846-8260	0.010	nd
Carbon Tetrachloride	56-23-5	SW-846-8260	0.030	nd
Bromodichloromethane	75-27-4	SW-846-8260	0.030	nd
1,2-Dichloropropane	78-87-5	SW-846-8260	0.010	nd
cis-1,3-Dichloropropene	10061-01-5	SW-846-8260	0.100	nd

**HIGH TECHNOLOGY LABORATORY, INC.**

P.O. Box 366950, San Juan, PR 00936-6950

Tel. (809) 793-7288 ; Fax 792-9280

Report No. 95-1727

Page 13

Parameter	CAS Number	EPA Method of Analysis	RL (ppm)	Amount Blank (1) (ppm)
Trichloroethene	79-01-6	SW-846-8260	0.030	nd
Dibromochloromethane	124-48-1	SW-846-8260	0.030	nd
1,1,2-Trichloroethane	79-00-5	SW-846-8260	0.010	nd
Benzene	71-43-2	SW-846-8260	0.050	nd
trans-1,3-Dichloropropene	10061-02-6	SW-846-8260	0.010	nd
Bromoform	75-25-2	SW-846-8260	0.060	nd
4-Methyl-2-Pentanone	108-10-1	SW-846-8260	0.100	nd
2-Hexanone	591-78-6	SW-846-8260	0.010	nd
Tetrachloroethene	127-18-4	SW-846-8260	0.010	nd
Toluene	108-88-3	SW-846-8260	0.050	nd
1,1,2,2-Tetrachloroethane	79-34-5	SW-846-8260	0.050	nd
Chlorobenzene	108-90-7	SW-846-8260	0.050	nd
Ethylbenzene	100-41-4	SW-846-8260	0.050	nd
Styrene	100-42-5	SW-846-8260	0.050	nd
m & p-xylene	---	SW-846-8260	0.100	nd
o-xylene	---	SW-846-8260	0.100	nd
1,2-Dichlorobenzene	95-50-1	SW-846-8260	0.020	nd
1,3-Dichlorobenzene	541-73-1	SW-846-8260	0.020	nd
1,4-Dichlorobenzene	106-46-7	SW-846-8260	0.020	nd

nd = non-detected (if present concentration below detection limit)

RL = Reporting Limit

ppm = Parts Per Million = milligrams per liter (liquids) or milligrams per kilogram (solids)

<b>Data Files</b>	<b>Date</b>	<b>Time</b>
B-1 BLK1206M	12-06-95	19:38

**HIGH TECHNOLOGY LABORATORY, INC.**

P.O. Box 366950, San Juan, PR 00936-6950

Tel. (809) 793-7288 ; Fax 792-9280

Report No. 95-1727

Page 14

# *Matrix Spike Report for VOC*

QC Batch Number

95-145

Units: ppm

Method: 846-8260

File: 12021-03S

Parameter	Amount Spiked	Original Amount	Amount Detected	Amount Recovered	Percent Recovered
Benzene	40	nd	27.5	27.5	69
Trichloroethene	40	nd	39.2	39.2	98
1,4 Dichlorobenzene	40	nd	43.9	43.9	110
Chlorobenzene	40	nd	39.7	39.7	99

nd= Non-Detected (if present, below detection limits)

\* = Matrix Spike Compounds suggested from method SW 846-8260

Parameter	QC Limits (% Recovery)	
	Aqueous	Solids
1,1-Dichloroethene	61-145	59-172
Benzene	76-127	66-142
Trichloroethene	71-120	82-137
Toluene	90-116	18-190
Chlorobenzene	75-130	60-133

# *Matrix Spike Duplicate Report for VOC*

QC Batch Number

95-145

Units: ppm

Method: 846-8260

File: 12021-03D

Parameter	Amount Spiked	Original Amount	Amount Detected	Amount Recovered	Percent Recovered	RPD
Benzene*	40	nd	21.1	21.1	53	26
Trichloroethene *	40	nd	37.6	37.6	94	4.1
1,4 Dichlorobenzene	40	nd	41.3	41.3	103	6.6
Chlorobenzene *	40	nd	38.3	38.3	96	3.0

**RPD** = Relative Percent Deviation to the Matrix Spike

nd= Non-Detected (if present, below detection limit)

Parameter	QC Limits (% Recovery)	
	Aqueous	Solids
1,1-Dichloroethene	61-145	59-172
Benzene	76-127	66-142
Trichloroethene	71-120	82-137
Toluene	90-116	18-190
Chlorobenzene	75-130	60-133

# *Blank Spike Report for SVOC*

QC Batch Number

95-063

Units: ppb  
File: BLK1128S

Method: 846-8270  
Date/Time: 11/28/95-18:43

Parameter	Conc. Spike Added (ug/L)	Sample results	Conc. in MS (ug/L)	% Rec	QC Limits (% rec)
1,4-Dichlorobenzene	100	nd	55	55	39-97
Acenaphthene	100	nd	70	70	46-118
2,4-Dinitrotoluene	100	nd	70	70	24-96
Pyrene	100	nd	57	57	26-127
1,2,4-Trichlorobenzene	100	nd	69	69	39-98
N-Nitroso-Di-n-Propylamine	100	nd	75	75	41-116
Pentachlorophenol	200	nd	242	121	9-103
2-Chlorophenol	200	nd	88	44	27-123
Phenol	200	nd	73	37	12-89
4-Chloro-3-methylphenol	200	nd	187	94	23-97
4-Nitrophenol	200	nd	66	33	10-80
Lindane	200	nd	102	51	56-123
Heptachlor	200	nd	166	83	40-131
Aldrin	200	nd	103	81	40-120
Dieldrin	500	nd	239	48	52-126
Endrin	500	nd	321	64	56-121
4,4'-DDT	500	nd	394	79	38-127

**HIGH TECHNOLOGY LABORATORY, INC.**

P.O. Box 3964, Guaynabo, PR 00970-3964  
Tel. (809) 790-0251 ; Fax 790-0474

Report No. 95-1727  
Page 17

# *Matrix Spike Report for SVOC*

QC Batch Number

95-063

Units: ppb  
File: 1702-01S

Method: 846-8270  
Date/Time: 11/28/95-23:51

Parameter	Conc. Spike Added (ug/L)	Sample results	Conc. in MS (ug/L)	% Rec	QC Limits (% rec)
1,4-Dichlorobenzene	100	nd	42	42	39-97
Acenaphthene	100	nd	44	44	46-118
2,4-Dinitrotoluene	100	nd	48	48	24-96
Pyrene	100	nd	48	48	26-127
1,2,4-Trichlorobenzene	100	nd	59	59	39-98
N-Nitroso-Di-n-Propylamine	100	nd	48	48	41-116
Pentachlorophenol	200	nd	167	84	9-103
2-Chlorophenol	200	nd	189	94	27-123
Phenol	200	nd	41	20	12-89
4-Chloro-3-methylphenol	200	nd	155	78	23-97
4-Nitrophenol	200	nd	37	19	10-80
Lindane	200	nd	48	24	56-123
Heptachlor	200	nd	80	40	40-131
Aldrin	200	nd	90	45	40-120
Dieldrin	500	nd	148	30	52-126
Endrin	500	nd	206	41	56-121
4,4'-DDT	500	nd	220	44	38-127

**HIGH TECHNOLOGY LABORATORY, INC.**

P.O. Box 3964, Guaynabo, PR 00970-3964  
Tel. (809) 790-0251 ; Fax 790-0474

Report No. 95-1727

Page 18

# *Matrix Spike Duplicate Report for SVOC*

QC Batch Number

95-063

Units: ppb  
File: 1695-01S

Method: 846-8270  
Date/Time: 11/29/95:20:52

Parameter	Conc. Spike Added (ug/L)	Sample results	Conc. in MS (ug/L)	% Rec	QC Limits (% rec)
1,4-Dichlorobenzene	100	nd	49	49	39-97
Acenaphthene	100	nd	77	77	46-118
2,4-Dinitrotoluene	100	nd	72	72	24-96
Pyrene	100	nd	71	71	26-127
1,2,4-Trichlorobenzene	100	nd	61	61	39-98
N-Nitroso-Di-n-Propylamine	100	nd	141	141	41-116
Pentachlorophenol	200	nd	130	65	9-103
2-Chlorophenol	200	nd	2	2	27-123
Phenol	200	115	129	65	12-89
4-Chloro-3-methylphenol	200	41	109	55	23-97
4-Nitrophenol	200	nd	0	0	10-80
Lindane	200	nd	86	43	56-123
Heptachlor	200	nd	0	0	40-131
Aldrin	200	nd	108	54	40-120
Dieldrin	500	nd	166	33	52-126
Endrin	500	nd	355	71	56-121
4,4'-DDT	500	nd	387	77	38-127

**HIGH TECHNOLOGY LABORATORY, INC.**

P.O. Box 3964, Guaynabo, PR 00970-3964  
Tel. (809) 790-0251 ; Fax 790-0474

Report No. 95-1727

Page 19

# *Replicate Report for SVOC*

QC Batch Number

95-063

Units: ppm

File 1: 1668-01

File 2: 1668-01R

Method: 846-8270

Dilution Factor 1:900

Dilution Factor 2:900

Parameter	Dilution 1	Amount Calculated	Dilution 2	Amount Calculated	Relative Percent Deviation
Di-n-butyl phthalate	0.021	0.023	0.032	0.036	52
Bis (2-ethylhexyl) phthalate	0.002	0.002	0.004	0.004	50

# Report Certification

Report No. 95-1334  
November 1st, 1995

Customer: Proteco  
Address: P.O. Box 850  
Peñuelas, P.R. 00624-0850  
Telephone:

Attention: Mr. René Rodríguez

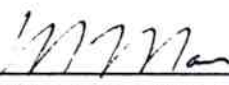
Dear Mr. Rodríguez:

Enclosed please find the report for the analyses you requested. A brief description of the procedures followed by the various analytical divisions of High Technology Laboratory (HTL) are found on the following page. The results for these analyses are reported in the "Result Table".

The quality control data and other supporting documentation pertaining to these analyses, are kept on file at the laboratory for a period of three (3) years. These records will be made available to you upon your request.


The results reported herein were obtained according to the analytical procedures described in our Laboratory SOP's and/or standard methods approved by regulatory agencies. At HTL, our laboratory and administrative procedures are supervised by qualified personnel and are performed following the guidelines of our Quality Assurance Manual.

Quality Assurance Certification by:

  
J. Roberto Ramírez, Ph.D.  
Quality Assurance Director



Quality Control Certification by:

  
Federico Asmar  
Quality Control Manager  
Lic. No. 2471

A 383291

**HIGH TECHNOLOGY LABORATORY, INC.**

P.O. Box 366950, San Juan, PR 00936-6950  
Tel. (809) 793-7288 ; Fax 792-9280

# Summary of Analytical Procedures

**Toxicity:** this characteristic is determined by the Toxicity Characteristic Leaching Procedure (TCLP), which is performed according to method SW-846-1311. From this procedure two TCLP extracts are obtained for analyses, one for volatile organics compounds (Zero Headspace Extraction (ZHE)) and the second for semivolatile, pesticides, herbicides and metals (Bottle Extraction). After this procedure, analyses of the extract is performed and the concentration of each analyte in the extract is reported.

## **Target Compound List (TCL)**

TCL parameters are one hundred and twenty five (125) organic compounds which are classified as follows: thirty three (33) are Volatile Organic Compounds (VOC), sixty four (64) are Semivolatile Organic Compounds (SVOC, these include Base/Neutral/Acids extractables parameters), twenty one (21) are Pesticides and seven (7) are Polychlorinated Biphenyls (PCB's).

All parameters are analyzed by Gas Chromatography/Mass Spectrometry (GC/MS). Identification of each parameter is done by comparison of the retention time and mass spectra of the parameter against a calibration standard analyzed within 12 hours. This calibration standard is injected after passing the tuning and performance check required by the method. After positive identification, quantitation of the parameters is performed by Internal Standard Calibration technique as described in the specific method.

The specific methodology used on each type of compound is as follows:

**Volatile Organic Compounds (VOC):** Sample preparation prior to analysis is performed by EPA method SW-846-5030 (Purge & Trap). In the case of samples with high content of VOC or VOC interferences, an extraction of 4 grams of the sample with 10 mL of methanol is performed. A measured amount of the methanol extract is then added to reagent water and inject into the Purge & Trap system prior to analysis by method SW-846-8260 (GC/MS using capillary column).

**Semivolatile Organic Compounds (SVOC), Pesticides and PCB's:** Sample preparation prior to analysis is performed base on sample matrix: a) Method SW-846-3510 (liquid-liquid extraction) for aqueous samples, b) Method SW-846-3550 (Ultrasonic extraction) for solid samples, c) Method SW-846-3580 (waste dilution) for liquid (non-aqueous) samples and d) sludge samples are filtrated to separate the liquid and solid phases, each phase is treated by the applicable method as described above and the results combined mathematically.

After preparation, an organic extract is obtained and analyzed by direct injection in the GC/MS using method SW-846-8270 (GC/MS using capillary column)

**PCB's:** For these parameters a mass selected screening is performed (as described within EPA Method SW-846-8270) for the masses characteristic of each PCB. If the screening is negative, no further analysis is requested by the method.

# Summary of analytical procedures

(Cont.)

## Inorganic Target Analyte List (TAL)

TAL are a list of inorganic parameters, which are, twenty three (23) metals and cyanide

TAL Metals: Prior to analyses, the sample is acid digested using microwave digestion methods. The specific method used for digestion varies with the sample matrix: a) Method SW-846-3015 for aqueous samples, b) Method SW-846-3051 for solid, sludge and oil samples. After digestion the aqueous extracts obtained is analyzed by Inductively Coupled Plasma Atomic Emission Spectroscopy (ICP-AES) following EPA method SW-846-6010, Mercury is analyzed by Cold Vapor Generation followed by Atomic Absorption Spectroscopy according to EPA method SW-846-7040. The concentration of each metal in the sample is determined using the dilution factors calculated from the preparation of the samples.

## Reporting Limits (RL)

RL are the minimum concentration of a substance that will be reported with 99% confidence that the analyte concentration is greater than zero and is determined from analysis of standards containing the analyte, these are greater or equal to the MDL's (Method Detection Limits) as defined in chapter one (1) of the SW-846 methods. The RL's for each analyte are presented in the result tables, these RL's are not corrected for the dilution or concentration factors and will be referred as  $RL_M$ . The actual RL's for each sample are corrected by the concentration or the dilution factors that came from the sample preparation procedures and will be referred as  $RL_S$ . The following are the corrections that should be applied to each kind of parameters:

VOC: after sample preparation, dilution factors ( $DF_{VOC}$ ) for the samples for VOC analyses are calculated, these factors are found in the Result Tables. The RL for each analyte in the sample ( $RL_S$ ) will be the respective RL in the table ( $RL_M$ ) multiply by the dilution factor for that sample:

$$RL_S = RL_M \times DF_{VOC}$$

SVOC: after sample preparation, concentration factors ( $CF_{SVOC}$ ) for the samples for SVOC analyses are calculated, these factors are found in the Result Tables. The RL for each analyte in the sample ( $RL_S$ ) will be the respective RL in the table ( $RL_M$ ) multiply by the concentration factor and divided by 1000:

$$RL_S = RL_M \times CF_{SVOC} / 1000$$

TAL Metals: after sample preparation, dilution factors ( $DF_{MET}$ ) for the samples for TAL analyses are calculated, these factors are found in the Result Tables. The RL for each analyte in the sample ( $RL_S$ ) will be the respective RL in the table ( $RL_M$ ) multiply by the dilution factor for that sample.

$$RL_S = RL_M \times DF_{VOC}$$

# *Volatile Organics Analysis Report*

*for*  
*Target Compound List (TCL)*

HTL Sample

95-1334-01

Sample ID:	Composite Oil Lagoon	Date Sampled:	October 3, 1995
Sample Matrix:	Soil	Sampled by:	F. Asmar/H. Cancel
Sample wt/vol:	1 mL of TCLP Extract	Date Received:	October 3, 1995
Dilution Factor:	5	TCLP Extraction:	October 4, 1995
Level (low/med):	Low	Date Analyzed:	October 5, 1995
Prep. method:	SW-846-5030	QC-Batch:	95-116
Analysis Method:	SW-846-8260		

Parameter	CAS Number	EPA Method of Analysis	RL (ppm)	Amount (ppm)
Chloromethane	74-87-3	SW-846-8260	0.002	nd
Bromomethane	74-83-9	SW-846-8260	0.004	nd
Vinyl chloride	75-01-4	SW-846-8260	0.005	nd
Chloroethane	75-00-3	SW-846-8260	0.002	nd
Methylene chloride	75-09-2	SW-846-8260	0.008	nd
Acetone	67-64-1	SW-846-8260	0.010	nd
Carbon Disulfide	75-15-0	SW-846-8260	0.010	nd
1,1-Dichloroethene	75-35-4	SW-846-8260	0.004	nd
1,1-Dichloroethane	75-34-3	SW-846-8260	0.002	nd
1,2-Dichloroethene (total)	540-59-0	SW-846-8260	0.010	nd
Chloroform	67-66-3	SW-846-8260	0.002	0.020
1,2-Dichloroethane	107-06-2	SW-846-8260	0.003	nd
2-Butanone	78-93-3	SW-846-8260	0.010	nd
1,1,1-Trichloroethane	71-55-6	SW-846-8260	0.001	nd
Carbon Tetrachloride	56-23-5	SW-846-8260	0.003	nd
Bromodichloromethane	75-27-4	SW-846-8260	0.003	nd
1,2-Dichloropropane	78-87-5	SW-846-8260	0.001	nd
cis-1,3-Dichloropropene	10061-01-5	SW-846-8260	0.010	nd

**HIGH TECHNOLOGY LABORATORY, INC.**

P.O. Box 366950, San Juan, PR 00936-6950

Tel. (809) 793-7288 ; Fax 792-9280



Report No. 95-1334

Page 4

# Volatile Organics Analysis Report

for  
Target Compound List (TCL)

Sample ID: Composite Oil Lagoon

HTL Sample No.95-1334-01

Parameter	CAS Number	EPA Method of Analysis	RL (ppm)	Amount (ppm)
Trichloroethene	79-01-6	SW-846-8260	0.003	nd
Dibromochloromethane	124-48-1	SW-846-8260	0.003	nd
1,1,2-Trichloroethane	79-00-5	SW-846-8260	0.001	nd
Benzene	71-43-2	SW-846-8260	0.005	0.065
trans-1,3-Dichloropropene	10061-02-6	SW-846-8260	0.001	nd
Bromoform	75-25-2	SW-846-8260	0.006	nd
4-Methyl-2-Pentanone	108-10-1	SW-846-8260	0.010	nd
2-Hexanone	591-78-6	SW-846-8260	0.001	nd
Tetrachloroethene	127-18-4	SW-846-8260	0.001	0.055
Toluene	108-88-3	SW-846-8260	0.005	nd
1,1,2,2-Tetrachloroethane	79-34-5	SW-846-8260	0.005	nd
Chlorobenzene	108-90-7	SW-846-8260	0.005	nd
Ethylbenzene	100-41-4	SW-846-8260	0.005	nd
Styrene	100-42-5	SW-846-8260	0.005	nd
Xylenes (Total)	1330-20-7	SW-846-8260	0.010	nd
1,2-Dichlorobenzene	95-50-1	SW-846-8260	0.002	nd
1,3-Dichlorobenzene	541-73-1	SW-846-8260	0.002	nd
1,4-Dichlorobenzene	106-46-7	SW-846-8260	0.002	nd

nd = non-detected (if present concentration below detection limit)

RL = Reporting Limit

ppm = Parts Per Million = milligrams per liter (liquids) or milligrams per kilogram (solids)



**HIGH TECHNOLOGY LABORATORY, INC.**

P.O. Box 366950, San Juan, PR 00936-6950

Tel. (809) 793-7288 ; Fax 792-9280

Report No. 95-1334

Page 5

# Semivolatile Organics Analysis Report

for  
Target Compound List (TCL)

HTL Sample

95-1334-01

Sample ID:	Composite Oil Lagoon	Date Sampled:	October 3, 1995
Sample Matrix:	Soil	Sampled by:	F. Asmar/H. Cancel
Sample wt/vol:	500 mL of TCLP Extract	Date Received:	October 3, 1995
Dilution Factor:	1000	TCLP Extraction:	October 4, 1995
Level (low/med):	Low	Date Extracted:	October 10, 1995
Extr. method:	SW-846-3510	Date Analyzed:	October 11, 1995
Analysis Method:	SW-846-8270	QC-Batch:	95-052

Parameter	CAS Number	EPA Method of Analysis	RL (ppm)	Amount (ppm)
Phenol	108-95-2	SW-846-8270	0.006	nd
Bis (2-chloroethyl) ether	111-44-4	SW-846-8270	0.003	nd
2-chlorophenol	95-57-8	SW-846-8270	0.003	nd
2-Methylphenol	95-48-7	SW-846-8270	0.006	nd
Bis (2-chloroisopropyl) ether	108-60-1	SW-846-8270	0.002	nd
4-Methylphenol	106-44-5	SW-846-8270	0.006	nd
N-nitroso-di-n-propylamine	621-64-7	SW-846-8270	0.003	nd
Hexachloroethane	67-72-1	SW-846-8270	0.002	nd
Nitrobenzene	98-95-3	SW-846-8270	0.003	nd
Isophorone	78-59-1	SW-846-8270	0.003	nd
2-nitrophenol	88-75-5	SW-846-8270	0.003	nd
2,4-dimethylphenol	105-67-9	SW-846-8270	0.003	nd
Bis (2-chloroethoxy) methane	111-91-1	SW-846-8270	0.006	nd
2,4-dichlorophenol	120-83-2	SW-846-8270	0.006	nd
1,2,4-trichlorobenzene	120-82-1	SW-846-8270	0.002	nd
Naphthalene	91-20-3	SW-846-8270	0.002	nd
4-Chloroaniline	106-47-8	SW-846-8270	0.005	nd

**HIGH TECHNOLOGY LABORATORY, INC.**

P.O. Box 366950, San Juan, PR 00936-6950  
Tel. (809) 793-7288 ; Fax 792-9280



Report No. 95-1334

Page 6

**Semivolatile Organics Analysis Report**  
for  
**Target Compound List (TCL)**

Sample ID: Composite Oil Lagoon

HTL Sample No. 95-1334-01

Parameter	CAS Number	EPA Method of Analysis	RL (ppm)	Amount (ppm)
Hexachlorobutadiene	87-68-3	SW-846-8270	0.002	nd
Parachlorometa cresol	59-50-7	SW-846-8270	0.006	nd
2-Methylnaphthalene	91-57-6	SW-846-8270	0.005	nd
Hexachlorocyclopentadiene	77-47-4	SW-846-8270	0.002	nd
2,4,6-trichlorophenol	88-06-2	SW-846-8270	0.008	nd
2,4,5-trichlorophenol	95-95-4	SW-846-8270	0.005	nd
2-chloronaphthalene	91-58-7	SW-846-8270	0.002	nd
2-nitroaniline	88-74-4	SW-846-8270	0.005	nd
Dimethyl phthalate	131-11-3	SW-846-8270	0.002	nd
Acenaphthylene	208-96-8	SW-846-8270	0.002	nd
2,6-Dinitrotoluene	606-20-2	SW-846-8270	0.002	nd
3-nitroaniline	99-09-2	SW-846-8270	0.005	nd
Acenaphthene	83-32-9	SW-846-8270	0.002	nd
2,4-dinitrophenol	51-28-5	SW-846-8270	0.003	nd
4-nitrophenol	100-02-7	SW-846-8270	0.005	nd
Dibenzofuran	132-64-9	SW-846-8270	0.005	nd
2,4-dinitrotoluene	121-14-2	SW-846-8270	0.003	nd
Diethylphthalate	84-66-2	SW-846-8270	0.003	nd
4-chlorophenyl phenyl ether	7005-72-3	SW-846-8270	0.002	nd
Fluorene	86-73-7	SW-846-8270	0.002	nd
4-Nitroaniline	100-01-6	SW-846-8270	0.009	nd
4,6-dinitro-o-cresol	534-52-1	SW-846-8270	0.003	nd
N-nitrosodiphenylamine	86-30-6	SW-846-8270	0.002	nd
4-bromophenyl phenyl ether	101-55-3	SW-846-8270	0.002	nd

**HIGH TECHNOLOGY LABORATORY, INC.**

P.O. Box 366950, San Juan, PR 00936-6950

Tel. (809) 793-7288 ; Fax 792-9280



Report No. 95-1334

Page 7

# Semivolatile Organics Analysis Report

for  
Target Compound List (TCL)

Sample ID: Composite Oil Lagoon

HTL Sample No. 95-1334-01

Parameter	CAS Number	EPA Method of Analysis	RL (ppm)	Amount (ppm)
Hexachlorobenzene	118-74-1	SW-846-8270	0.005	nd
Pentachlorophenol	87-86-5	SW-846-8270	0.003	nd
Phenanthrene	85-01-8	SW-846-8270	0.002	nd
Anthracene	120-12-7	SW-846-8270	0.002	nd
Carbazole	86-74-8	SW-846-8270	0.005	nd
Di-n-butyl phthalate	84-74-2	SW-846-8270	0.002	nd
Fluoranthene	206-44-0	SW-846-8270	0.002	nd
Pyrene	129-00-0	SW-846-8270	0.002	nd
Butyl benzyl phthalate	85-68-7	SW-846-8270	0.002	nd
3,3'-dichlorobenzidine	91-94-1	SW-846-8270	0.002	nd
Benzo(a)anthracene	56-55-3	SW-846-8270	0.002	nd
Chrysene	218-01-9	SW-846-8270	0.002	nd
Bis (2-ethylhexyl) phthalate	117-81-7	SW-846-8270	0.002	nd
Di-n-octyl phthalate	117-84-0	SW-846-8270	0.002	nd
Benzo(b)fluoranthene	205-99-2	SW-846-8270	0.002	nd
Benzo(k)fluoranthene	207-08-9	SW-846-8270	0.002	nd
Benzo(a)pyrene	50-32-8	SW-846-8270	0.002	nd
Indeno(1,2,3-cd)pyrene	193-39-5	SW-846-8270	0.002	nd
Dibenzo(a,h)anthracene	53-70-3	SW-846-8270	0.002	nd
Benzo(ghi)perylene	191-24-2	SW-846-8270	0.002	nd

nd = non-detected (if present concentration below detection limit)

RL = Reporting Limit

ppm = Parts Per Million = milligrams per liter (liquids) or milligrams per kilogram (solids)



**HIGH TECHNOLOGY LABORATORY, INC.**

P.O. Box 366950, San Juan, PR 00936-6950

Tel. (809) 793-7288 ; Fax 792-9280

Report No. 95-1334

Page 8

# *Pesticides & PCB's Analysis Report*

for  
*Target Compound List (TCL)*

HTL Sample

95-1334-01

<b>Sample ID:</b>	Composite Oil Lagoon	<b>Date Sampled:</b>	October 3, 1995
<b>Sample Matrix:</b>	Soil	<b>Sampled by:</b>	F. Asmar/H. Cancel
<b>Sample wt/vol:</b>	500 mL of TCLP Extract	<b>Date Received:</b>	October 3, 1995
<b>Dilution Factor:</b>	1000	<b>TCLP Extraction:</b>	October 4, 1995
<b>Level (low/med):</b>	Low	<b>Date Extracted:</b>	October 10, 1995
<b>Extr. method:</b>	SW-846-3510	<b>Date Analyzed:</b>	October 11, 1995
<b>Analysis Method:</b>	SW-846-8270	<b>QC-Batch:</b>	95-052

Parameter	CAS Number	EPA Method of Analysis	RL (ppm)	Amount (ppm)
Alpha-BHC	319-84-6	SW-846-8270	0.003	nd
Beta-BHC	319-85-7	SW-846-8270	0.003	nd
Delta-BHC	319-86-8	SW-846-8270	0.003	nd
Gamma-BHC (Lindane)	58-89-9	SW-846-8270	0.003	nd
Heptachlor	76-44-8	SW-846-8270	0.003	nd
Aldrin	309-00-2	SW-846-8270	0.003	nd
Heptachlor epoxide	1024-57-3	SW-846-8270	0.003	nd
Alpha-Endosulfan	959-98-8	SW-846-8270	0.006	nd
Dieldrin	60-57-1	SW-846-8270	0.006	nd
4,4-DDE	72-55-9	SW-846-8270	0.006	nd
Endrin	72-20-8	SW-846-8270	0.006	nd
Beta-Endosulfan	33212-65-9	SW-846-8270	0.006	nd
4,4-DDT	50-29-3	SW-846-8270	0.002	nd
Methoxychlor	72-43-5	SW-846-8270	0.002	nd
Endrin Ketone	53494-70-5	SW-846-8270	0.002	nd
Endrin aldehyde	7421-93-4	SW-846-8270	0.002	nd
Alpha-Chlordane	5103-71-9	SW-846-8270	0.005	nd

**HIGH TECHNOLOGY LABORATORY, INC.**

P.O. Box 366950, San Juan, PR 00936-6950  
Tel. (809) 793-7288 ; Fax 792-9280



Report No. 95-1334

Page 9

***Pesticides & PCB's Analysis Report***  
*for*  
***Target Compound List (TCL)***

Sample ID: Composite Oil Lagoon

HTL Sample No. 95-1334-01

Parameter	CAS Number	EPA Method of Analysis	RL (ppm)	Amount (ppm)
Gamma-Chlordane	5103-74-2	SW-846-8270	0.005	nd
Toxaphene	8001-35-2	SW-846-8270	0.005	nd
PCB-1016	12674-11-2	SW-846-8270	0.005	nd
PCB-1221	11104-28-2	SW-846-8270	0.005	nd
PCB-1232	11141-16-5	SW-846-8270	0.005	nd
PCB-1242	53469-21-9	SW-846-8270	0.005	nd
PCB-1248	12672-29-6	SW-846-8270	0.005	nd
PCB-1254	11097-69-1	SW-846-8270	0.005	nd
PCB-1260	11096-82-5	SW-846-8270	0.005	nd

nd = non-detected (if present concentration below detection limit)

RL = Reporting Limit

ppm = Parts Per Million = milligrams per liter (liquids) or milligrams per kilogram (solids)



***HIGH TECHNOLOGY LABORATORY, INC.***

P.O. Box 366950, San Juan, PR 00936-6950

Tel. (809) 793-7288 ; Fax 792-9280

Report No. 95-1334

Page 10

# *Metals Analysis Report*

*for*  
*Inorganic Target Analyte List (TAL)*

HTL Sample

95-1334-01

<b>Sample ID:</b>	Composite Oil Lagoon	<b>Date Sampled:</b>	October 3, 1995
<b>Sample Matrix:</b>	Soil	<b>Sampled by:</b>	F. Asmar/H. Cancel
<b>Sample wt/vol:</b>	25.0 mL of TCLP Extract	<b>Date Received:</b>	October 3, 1995
<b>Dilution Factor:</b>	2.0	<b>TCLP Extraction:</b>	October 4, 1995
<b>Level (low/med):</b>	Low	<b>Date Digested:</b>	October 19, 1995
<b>Digestion method:</b>	SW-846-3015	<b>Date Analyzed:</b>	October 19 to 24, 1995
<b>Analysis Method:</b>	SW-846-6010	<b>QC-Batch:</b>	95-157

Parameter	CAS Number	EPA Method	RL (ppm)	Amount (ppm)
Aluminum	7429-90-5	3120B	0.011	nd
Antimony	7440-36-0	3120B	0.011	nd
Arsenic	7440-38-2	3120B	0.010	nd
Barium	7440-39-3	3120B	0.001	nd
Beryllium	7440-41-7	3120B	0.001	nd
Cadmium	7440-43-9	3120B	0.001	nd
Calcium	7440-70-2	3120B	0.011	789
Chromium	7440-47-3	3120B	0.001	nd
Cobalt	7440-48-4	3120B	0.001	nd
Copper	7440-50-8	3120B	0.007	nd
Iron	7439-89-6	3120B	0.001	2.63
Lead	7439-92-1	3120B	0.005	nd
Magnesium	7439-95-4	3120B	0.003	25.3
Manganese	7439-96-5	3120B	0.001	1.25
Mercury	7439-97-6	3112B	0.002	nd
Nickel	7440-02-0	3120B	0.001	0.837
Potassium	7440-09-7	3120B	0.006	18.7

**HIGH TECHNOLOGY LABORATORY, INC.**

P.O. Box 366950, San Juan, PR 00936-6950

Tel. (809) 793-7288 ; Fax 792-9280



Report No. 95-1334

Page 11

***Metals Analysis Report***  
***for***  
***Inorganic Target Analyte List (TCL)***

**Sample ID:** Composite Oil Lagoon

**HTL Sample No.** 95-1334-01

Parameter	CAS Number	EPA Method	RL (ppm)	Amount (ppm)
Selenium	7782-49-2	3120B	0.013	nd
Silver	7440-22-4	3120B	0.001	nd
Sodium	7440-23-5	3120B	0.061	nd
Thallium	7440-28-0	3120B	0.023	nd
Vanadium	7440-62-2	3120B	0.001	0.059
Zinc	7440-66-6	3120B	0.009	0.205

nd = non-detected (if present concentration below detection limit)

RL = Reporting Limit

ppm = Parts Per Million = milligrams per liter (liquids) or milligrams per kilogram (solids)



***HIGH TECHNOLOGY LABORATORY, INC.***

P.O. Box 366950, San Juan, PR 00936-6950

Tel. (809) 793-7288 ; Fax 792-9280

**Report No.** 95-1334

**Page** 12

# Volatile Organics Analysis Report

for  
Target Compound List (TCL)

HTL Sample

95-1334-02

Sample ID: Equipment Blank  
 Sample Matrix: Aqueous  
 Sample wt/vol: 5 mL of TCLP Extract  
 Dilution Factor: 1  
 Level (low/med): Low  
 Prep. method: SW-846-5030  
 Analysis Method: SW-846-8260

Date Sampled: October 3, 1995  
 Sampled by: F. Asmar/H. Cancel  
 Date Received: October 3, 1995  
 TCLP Extraction: October 4, 1995  
 Date Analyzed: October 6, 1995  
 QC-Batch: 95-116

Parameter	CAS Number	EPA Method of Analysis	RL (ppm)	Amount (ppm)
Chloromethane	74-87-3	SW-846-8260	0.002	nd
Bromomethane	74-83-9	SW-846-8260	0.004	nd
Vinyl chloride	75-01-4	SW-846-8260	0.005	nd
Chloroethane	75-00-3	SW-846-8260	0.002	nd
Methylene chloride	75-09-2	SW-846-8260	0.008	nd
Acetone	67-64-1	SW-846-8260	0.010	nd
Carbon Disulfide	75-15-0	SW-846-8260	0.010	nd
1,1-Dichloroethene	75-35-4	SW-846-8260	0.004	nd
1,1-Dichloroethane	75-34-3	SW-846-8260	0.002	nd
1,2-Dichloroethene (total)	540-59-0	SW-846-8260	0.010	nd
Chloroform	67-66-3	SW-846-8260	0.002	nd
1,2-Dichloroethane	107-06-2	SW-846-8260	0.003	nd
2-Butanone	78-93-3	SW-846-8260	0.010	nd
1,1,1-Trichloroethane	71-55-6	SW-846-8260	0.001	nd
Carbon Tetrachloride	56-23-5	SW-846-8260	0.003	nd
Bromodichloromethane	75-27-4	SW-846-8260	0.003	nd
1,2-Dichloropropane	78-87-5	SW-846-8260	0.001	nd
cis-1,3-Dichloropropene	10061-01-5	SW-846-8260	0.010	nd

**HIGH TECHNOLOGY LABORATORY, INC.**

P.O. Box 366950, San Juan, PR 00936-6950  
 Tel. (809) 793-7288 ; Fax 792-9280



Report No. 95-1334

Page 13

***Volatile Organics Analysis Report***  
for  
***Target Compound List (TCL)***

Sample ID: Equipment Blank

HTL Sample No.95-1334-02

Parameter	CAS Number	EPA Method of Analysis	RL (ppm)	Amount (ppm)
Trichloroethene	79-01-6	SW-846-8260	0.003	nd
Dibromochloromethane	124-48-1	SW-846-8260	0.003	nd
1,1,2-Trichloroethane	79-00-5	SW-846-8260	0.001	nd
Benzene	71-43-2	SW-846-8260	0.005	nd
trans-1,3-Dichloropropene	10061-02-6	SW-846-8260	0.001	nd
Bromoform	75-25-2	SW-846-8260	0.006	nd
4-Methyl-2-Pentanone	108-10-1	SW-846-8260	0.010	nd
2-Hexanone	591-78-6	SW-846-8260	0.001	nd
Tetrachloroethene	127-18-4	SW-846-8260	0.001	nd
Toluene	108-88-3	SW-846-8260	0.005	nd
1,1,2,2-Tetrachloroethane	79-34-5	SW-846-8260	0.005	nd
Chlorobenzene	108-90-7	SW-846-8260	0.005	nd
Ethylbenzene	100-41-4	SW-846-8260	0.005	nd
Styrene	100-42-5	SW-846-8260	0.005	nd
Xylenes (Total)	1330-20-7	SW-846-8260	0.010	nd
1,2-Dichlorobenzene	95-50-1	SW-846-8260	0.002	nd
1,3-Dichlorobenzene	541-73-1	SW-846-8260	0.002	nd
1,4-Dichlorobenzene	106-46-7	SW-846-8260	0.002	nd

nd = non-detected (if present concentration below detection limit)

RL = Reporting Limit

ppm = Parts Per Million = milligrams per liter (liquids) or milligrams per kilogram (solids)



**HIGH TECHNOLOGY LABORATORY, INC.**

P.O. Box 366950, San Juan, PR 00936-6950

Tel. (809) 793-7288 ; Fax 792-9280

Report No. 95-1334

Page 14

# Semivolatile Organics Analysis Report

for  
Target Compound List (TCL)

HTL Sample

95-1334-02

Sample ID:	Equipment Blank	Date Sampled:	October 3, 1995
Sample Matrix:	Aqueous	Sampled by:	F. Asmar/H. Cancel
Sample wt/vol:	500 mL of TCLP Extract	Date Received:	October 3, 1995
Dilution Factor:	1000	TCLP Extraction:	October 4, 1995
Level (low/med):	Low	Date Extracted:	October 4, 1995
Extr. method:	SW-846-3510	Date Analyzed:	October 7, 1995
Analysis Method:	SW-846-8270	QC-Batch:	95-050

Parameter	CAS Number	EPA Method of Analysis	RL (ppm)	Amount (ppm)
Phenol	108-95-2	SW-846-8270	0.006	nd
Bis (2-chloroethyl) ether	111-44-4	SW-846-8270	0.003	nd
2-chlorophenol	95-57-8	SW-846-8270	0.003	nd
2-Methylphenol	95-48-7	SW_846-8270	0.006	nd
Bis (2-chloroisopropyl) ether	108-60-1	SW-846-8270	0.002	nd
4-Methylphenol	106-44-5	SW-846-8270	0.006	nd
N-nitroso-di-n-propylamine	621-64-7	SW-846-8270	0.003	nd
Hexachloroethane	67-72-1	SW-846-8270	0.002	nd
Nitrobenzene	98-95-3	SW-846-8270	0.003	nd
Isophorone	78-59-1	SW-846-8270	0.003	nd
2-nitrophenol	88-75-5	SW-846-8270	0.003	nd
2,4-dimethylphenol	105-67-9	SW-846-8270	0.003	nd
Bis (2-chloroethoxy) methane	111-91-1	SW-846-8270	0.006	nd
2,4-dichlorophenol	120-83-2	SW-846-8270	0.006	nd
1,2,4-trichlorobenzene	120-82-1	SW-846-8270	0.002	nd
Naphthalene	91-20-3	SW-846-8270	0.002	nd
4-Chloroaniline	106-47-8	SW-846-8270	0.005	nd

**HIGH TECHNOLOGY LABORATORY, INC.**

P.O. Box 366950, San Juan, PR 00936-6950  
Tel. (809) 793-7288 ; Fax 792-9280



Report No. 95-1334  
Page 15

**Semivolatile Organics Analysis Report**  
for  
**Target Compound List (TCL)**

Sample ID: Equipment Blank

HTL Sample No. 95-1334-02

Parameter	CAS Number	EPA Method of Analysis	RL (ppm)	Amount (ppm)
Hexachlorobutadiene	87-68-3	SW-846-8270	0.002	nd
Parachlorometa cresol	59-50-7	SW-846-8270	0.006	nd
2-Methylnaphthalene	91-57-6	SW-846-8270	0.005	nd
Hexachlorocyclopentadiene	77-47-4	SW-846-8270	0.002	nd
2,4,6-trichlorophenol	88-06-2	SW-846-8270	0.008	nd
2,4,5-trichlorophenol	95-95-4	SW-846-8270	0.005	nd
2-chloronaphthalene	91-58-7	SW-846-8270	0.002	nd
2-nitroaniline	88-74-4	SW-846-8270	0.005	nd
Dimethyl phthalate	131-11-3	SW-846-8270	0.002	nd
Acenaphthylene	208-96-8	SW-846-8270	0.002	nd
2,6-Dinitrotoluene	606-20-2	SW-846-8270	0.002	nd
3-nitroaniline	99-09-2	SW-846-8270	0.005	nd
Acenaphthene	83-32-9	SW-846-8270	0.002	nd
2,4-dinitrophenol	51-28-5	SW-846-8270	0.003	nd
4-nitrophenol	100-02-7	SW-846-8270	0.005	nd
Dibenzofuran	132-64-9	SW-846-8270	0.005	nd
2,4-dinitrotoluene	121-14-2	SW-846-8270	0.003	nd
Diethylphthalate	84-66-2	SW-846-8270	0.003	nd
4-chlorophenyl phenyl ether	7005-72-3	SW-846-8270	0.002	nd
Fluorene	86-73-7	SW-846-8270	0.002	nd
4-Nitroaniline	100-01-6	SW-846-8270	0.009	nd
4,6-dinitro-o-cresol	534-52-1	SW-846-8270	0.003	nd
N-nitrosodiphenylamine	86-30-6	SW-846-8270	0.002	nd
4-bromophenyl phenyl ether	101-55-3	SW-846-8270	0.002	nd

**HIGH TECHNOLOGY LABORATORY, INC.**

P.O. Box 366950, San Juan, PR 00936-6950  
Tel. (809) 793-7288 ; Fax 792-9280



Report No. 95-1334  
Page 16

**Semivolatile Organics Analysis Report**  
for  
**Target Compound List (TCL)**

Sample ID: Equipment Blank

HTL Sample No. 95-1334-02

Parameter	CAS Number	EPA Method of Analysis	RL (ppm)	Amount (ppm)
Hexachlorobenzene	118-74-1	SW-846-8270	0.005	nd
Pentachlorophenol	87-86-5	SW-846-8270	0.003	nd
Phenanthrene	85-01-8	SW-846-8270	0.002	nd
Anthracene	120-12-7	SW-846-8270	0.002	nd
Carbazole	86-74-8	SW-846-8270	0.005	nd
Di-n-butyl phthalate	84-74-2	SW-846-8270	0.002	0.004
Fluoranthene	206-44-0	SW-846-8270	0.002	nd
Pyrene	129-00-0	SW-846-8270	0.002	nd
Butyl benzyl phthalate	85-68-7	SW-846-8270	0.002	nd
3,3'-dichlorobenzidine	91-94-1	SW-846-8270	0.002	nd
Benzo(a)anthracene	56-55-3	SW-846-8270	0.002	nd
Chrysene	218-01-9	SW-846-8270	0.002	nd
Bis (2-ethylhexyl) phthalate	117-81-7	SW-846-8270	0.002	nd
Di-n-octyl phthalate	117-84-0	SW-846-8270	0.002	nd
Benzo(b)fluoranthene	205-99-2	SW-846-8270	0.002	nd
Benzo(k)fluoranthene	207-08-9	SW-846-8270	0.002	nd
Benzo(a)pyrene	50-32-8	SW-846-8270	0.002	nd
Indeno(1,2,3-cd)pyrene	193-39-5	SW-846-8270	0.002	nd
Dibenzo(a,h)anthracene	53-70-3	SW-846-8270	0.002	nd
Benzo(ghi)perylene	191-24-2	SW-846-8270	0.002	nd

nd = non-detected (if present concentration below detection limit)

RL = Reporting Limit

ppm = Parts Per Million = milligrams per liter (liquids) or milligrams per kilogram (solids)



**HIGH TECHNOLOGY LABORATORY, INC.**

P.O. Box 366950, San Juan, PR 00936-6950

Tel. (809) 793-7288 ; Fax 792-9280

Report No. 95-1334

Page 17

# Pesticides & PCB's Analysis Report

for  
Target Compound List (TCL)

HTL Sample

95-1334-02

Sample ID:	Equipment Blank	Date Sampled:	October 3, 1995
Sample Matrix:	Aqueous	Sampled by:	F. Asmar/H. Cancel
Sample wt/vol:	500 mL of TCLP Extract	Date Received:	October 3, 1995
Dilution Factor:	1000	TCLP Extraction:	October 4, 1995
Level (low/med):	Low	Date Extracted:	October 4, 1995
Extr. method:	SW-846-3510	Date Analyzed:	October 7, 1995
Analysis Method:	SW-846-8270	QC-Batch:	95-050

Parameter	CAS Number	EPA Method of Analysis	RL (ppm)	Amount (ppm)
Alpha-BHC	319-84-6	SW-846-8270	0.003	nd
Beta-BHC	319-85-7	SW-846-8270	0.003	nd
Delta-BHC	319-86-8	SW-846-8270	0.003	nd
Gamma-BHC (Lindane)	58-89-9	SW-846-8270	0.003	nd
Heptachlor	76-44-8	SW-846-8270	0.003	nd
Aldrin	309-00-2	SW-846-8270	0.003	nd
Heptachlor epoxide	1024-57-3	SW-846-8270	0.003	nd
Alpha-Endosulfan	959-98-8	SW-846-8270	0.006	nd
Dieldrin	60-57-1	SW-846-8270	0.006	nd
4,4-DDE	72-55-9	SW-846-8270	0.006	nd
Endrin	72-20-8	SW-846-8270	0.006	nd
Beta-Endosulfan	33212-65-9	SW-846-8270	0.006	nd
4,4-DDT	50-29-3	SW-846-8270	0.002	nd
Methoxychlor	72-43-5	SW-846-8270	0.002	nd
Endrin Ketone	53494-70-5	SW-846-8270	0.002	nd
Endrin aldehyde	7421-93-4	SW-846-8270	0.002	nd
Alpha-Chlordane	5103-71-9	SW-846-8270	0.005	nd

**HIGH TECHNOLOGY LABORATORY, INC.**

P.O. Box 366950, San Juan, PR 00936-6950  
Tel. (809) 793-7288 ; Fax 792-9280



Report No. 95-1334

Page 18

***Pesticides & PCB's Analysis Report***  
*for*  
***Target Compound List (TCL)***

Sample ID: Equipment Blank

HTL Sample No. 95-1334-02

Parameter	CAS Number	EPA Method of Analysis	RL (ppm)	Amount (ppm)
Gamma-Chlordane	5103-74-2	SW-846-8270	0.005	nd
Toxaphene	8001-35-2	SW-846-8270	0.005	nd
PCB-1016	12674-11-2	SW-846-8270	0.005	nd
PCB-1221	11104-28-2	SW-846-8270	0.005	nd
PCB-1232	11141-16-5	SW-846-8270	0.005	nd
PCB-1242	53469-21-9	SW-846-8270	0.005	nd
PCB-1248	12672-29-6	SW-846-8270	0.005	nd
PCB-1254	11097-69-1	SW-846-8270	0.005	nd
PCB-1260	11096-82-5	SW-846-8270	0.005	nd

nd = non-detected (if present concentration below detection limit)

RL = Reporting Limit

ppm = Parts Per Million = milligrams per liter (liquids) or milligrams per kilogram (solids)



***HIGH TECHNOLOGY LABORATORY, INC.***

P.O. Box 366950, San Juan, PR 00936-6950

Tel. (809) 793-7288 ; Fax 792-9280

Report No. 95-1334

Page 19

# *Metals Analysis Report*

*for*  
*Inorganic Target Analyte List (TAL)*

HTL Sample

95-1334-02

<b>Sample ID:</b>	Equipment Blank	<b>Date Sampled:</b>	October 3, 1995
<b>Sample Matrix:</b>	Aqueous	<b>Sampled by:</b>	F. Asmar/H. Cancel
<b>Sample wt/vol:</b>	25.0 mL of TCLP Extract	<b>Date Received:</b>	October 3, 1995
<b>Dilution Factor:</b>	2.0	<b>TCLP Extraction:</b>	October 4, 1995
<b>Level (low/med):</b>	Low	<b>Date Digested:</b>	October 4, 1995
<b>Digestion method:</b>	SW-846-3015	<b>Date Analyzed:</b>	October 9 to 11, 1995
<b>Analysis Method:</b>	SW-846-6010	<b>QC-Batch:</b>	95-158

Parameter	CAS Number	EPA Method	RL (ppm)	Amount (ppm)
Aluminum	7429-90-5	3120B	0.011	nd
Antimony	7440-36-0	3120B	0.011	nd
Arsenic	7440-38-2	3120B	0.010	nd
Barium	7440-39-3	3120B	0.001	nd
Beryllium	7440-41-7	3120B	0.001	nd
Cadmium	7440-43-9	3120B	0.001	nd
Calcium	7440-70-2	3120B	0.011	0.290
Chromium	7440-47-3	3120B	0.001	nd
Cobalt	7440-48-4	3120B	0.001	nd
Copper	7440-50-8	3120B	0.007	nd
Iron	7439-89-6	3120B	0.001	nd
Lead	7439-92-1	3120B	0.005	nd
Magnesium	7439-95-4	3120B	0.003	0.205
Manganese	7439-96-5	3120B	0.001	nd
Mercury	7439-97-6	3112B	0.002	nd
Nickel	7440-02-0	3120B	0.001	nd
Potassium	7440-09-7	3120B	0.001	0.373

**HIGH TECHNOLOGY LABORATORY, INC.**

P.O. Box 366950, San Juan, PR 00936-6950

Tel. (809) 793-7288 ; Fax 792-9280



Report No. 95-1334

Page 20

**Metals Analysis Report**  
*for*  
**Inorganic Target Analyte List (TCL)**

Sample ID: Equipment Blank

HTL Sample No. 95-1334-02

Parameter	CAS Number	EPA Method	RL (ppm)	Amount (ppm)
Selenium	7782-49-2	3120B	0.013	nd
Silver	7440-22-4	3120B	0.001	nd
Sodium	7440-23-5	3120B	0.061	2.11
Thallium	7440-28-0	3120B	0.023	nd
Vanadium	7440-62-2	3120B	0.001	nd
Zinc	7440-66-6	3120B	0.009	nd

nd = non-detected (if present concentration below detection limit)

RL = Reporting Limit

ppm = Parts Per Million = milligrams per liter (liquids) or milligrams per kilogram (solids)



**HIGH TECHNOLOGY LABORATORY, INC.**

P.O. Box 366950, San Juan, PR 00936-6950  
Tel. (809) 793-7288 ; Fax 792-9280

Report No. 95-1334  
Page 21

# *Volatile Organics Analysis Report*

*for*  
*Target Compound List (TCL)*

HTL Sample

95-1334-03

Sample ID: Field Blank  
Sample Matrix: Aqueous  
Sample wt/vol: 5 mL of TCLP Extract  
Dilution Factor: 1  
Level (low/med): Low  
Prep. method: SW-846-5030  
Analysis Method: SW-846-8260

Date Sampled: October 3, 1995  
Sampled by: F. Asmar/H. Cancel  
Date Received: October 3, 1995  
TCLP Extraction: October 4, 1995  
Date Analyzed: October 6, 1995  
QC-Batch: 95-116

Parameter	CAS Number	EPA Method of Analysis	RL (ppm)	Amount (ppm)
Chloromethane	74-87-3	SW-846-8260	0.002	nd
Bromomethane	74-83-9	SW-846-8260	0.004	nd
Vinyl chloride	75-01-4	SW-846-8260	0.005	nd
Chloroethane	75-00-3	SW-846-8260	0.002	nd
Methylene chloride	75-09-2	SW-846-8260	0.008	nd
Acetone	67-64-1	SW-846-8260	0.010	0.116
Carbon Disulfide	75-15-0	SW-846-8260	0.010	nd
1,1-Dichloroethene	75-35-4	SW-846-8260	0.004	nd
1,1-Dichloroethane	75-34-3	SW-846-8260	0.002	nd
1,2-Dichloroethene (total)	540-59-0	SW-846-8260	0.010	nd
Chloroform	67-66-3	SW-846-8260	0.002	nd
1,2-Dichloroethane	107-06-2	SW-846-8260	0.003	nd
2-Butanone	78-93-3	SW-846-8260	0.010	nd
1,1,1-Trichloroethane	71-55-6	SW-846-8260	0.001	nd
Carbon Tetrachloride	56-23-5	SW-846-8260	0.003	nd
Bromodichloromethane	75-27-4	SW-846-8260	0.003	nd
1,2-Dichloropropane	78-87-5	SW-846-8260	0.001	nd
cis-1,3-Dichloropropene	10061-01-5	SW-846-8260	0.010	nd

**HIGH TECHNOLOGY LABORATORY, INC.**

P.O. Box 366950, San Juan, PR 00936-6950  
Tel. (809) 793-7288 ; Fax 792-9280



Report No. 95-1334  
Page 22

***Volatile Organics Analysis Report***  
for  
***Target Compound List (TCL)***

Sample ID: Field Blank

HTL Sample No.95-1334-03

Parameter	CAS Number	EPA Method of Analysis	RL (ppm)	Amount (ppm)
Trichloroethene	79-01-6	SW-846-8260	0.003	nd
Dibromochloromethane	124-48-1	SW-846-8260	0.003	nd
1,1,2-Trichloroethane	79-00-5	SW-846-8260	0.001	nd
Benzene	71-43-2	SW-846-8260	0.005	nd
trans-1,3-Dichloropropene	10061-02-6	SW-846-8260	0.001	nd
Bromoform	75-25-2	SW-846-8260	0.006	nd
4-Methyl-2-Pentanone	108-10-1	SW-846-8260	0.010	nd
2-Hexanone	591-78-6	SW-846-8260	0.001	nd
Tetrachloroethene	127-18-4	SW-846-8260	0.001	nd
Toluene	108-88-3	SW-846-8260	0.005	nd
1,1,2,2-Tetrachloroethane	79-34-5	SW-846-8260	0.005	nd
Chlorobenzene	108-90-7	SW-846-8260	0.005	nd
Ethylbenzene	100-41-4	SW-846-8260	0.005	nd
Styrene	100-42-5	SW-846-8260	0.005	nd
Xylenes (Total)	1330-20-7	SW-846-8260	0.010	nd
1,2-Dichlorobenzene	95-50-1	SW-846-8260	0.002	nd
1,3-Dichlorobenzene	541-73-1	SW-846-8260	0.002	nd
1,4-Dichlorobenzene	106-46-7	SW-846-8260	0.002	nd

nd = non-detected (if present concentration below detection limit)

RL = Reporting Limit

ppm = Parts Per Million = milligrams per liter (liquids) or milligrams per kilogram (solids)



**HIGH TECHNOLOGY LABORATORY, INC.**

P.O. Box 366950, San Juan, PR 00936-6950

Tel: (809) 793-7288 ; Fax 792-9280

Report No. 95-1334

Page 23

# Semivolatile Organics Analysis Report

for  
Target Compound List (TCL)

HTL Sample

95-1334-03

Sample ID:	Field Blank	Date Sampled:	October 3, 1995
Sample Matrix:	Aqueous	Sampled by:	F. Asmar/H. Cancel
Sample wt/vol:	500 mL of TCLP Extract	Date Received:	October 3, 1995
Dilution Factor:	1000	TCLP Extraction:	October 4, 1995
Level (low/med):	Low	Date Extracted:	October 4, 1995
Extr. method:	SW-846-3510	Date Analyzed:	October 7, 1995
Analysis Method:	SW-846-8270	QC-Batch:	95-050

Parameter	CAS Number	EPA Method of Analysis	RL (ppm)	Amount (ppm)
Phenol	108-95-2	SW-846-8270	0.006	nd
Bis (2-chloroethyl) ether	111-44-4	SW-846-8270	0.003	nd
2-chlorophenol	95-57-8	SW-846-8270	0.003	nd
2-Methylphenol	95-48-7	SW-846-8270	0.006	nd
Bis (2-chloroisopropyl) ether	108-60-1	SW-846-8270	0.002	nd
4-Methylphenol	106-44-5	SW-846-8270	0.006	nd
N-nitroso-di-n-propylamine	621-64-7	SW-846-8270	0.003	nd
Hexachloroethane	67-72-1	SW-846-8270	0.002	nd
Nitrobenzene	98-95-3	SW-846-8270	0.003	nd
Isophorone	78-59-1	SW-846-8270	0.003	nd
2-nitrophenol	88-75-5	SW-846-8270	0.003	nd
2,4-dimethylphenol	105-67-9	SW-846-8270	0.003	nd
Bis (2-chloroethoxy) methane	111-91-1	SW-846-8270	0.006	nd
2,4-dichlorophenol	120-83-2	SW-846-8270	0.006	nd
1,2,4-trichlorobenzene	120-82-1	SW-846-8270	0.002	nd
Naphthalene	91-20-3	SW-846-8270	0.002	nd
4-Chloroaniline	106-47-8	SW-846-8270	0.005	nd

**HIGH TECHNOLOGY LABORATORY, INC.**

P.O. Box 366950, San Juan, PR 00936-6950

Tel. (809) 793-7288 ; Fax 792-9280



Report No. 95-1334

Page 24

**Semivolatile Organics Analysis Report**  
for  
**Target Compound List (TCL)**

Sample ID: Field Blank

HTL Sample No. 95-1334-03

Parameter	CAS Number	EPA Method of Analysis	RL (ppm)	Amount (ppm)
Hexachlorobutadiene	87-68-3	SW-846-8270	0.002	nd
Parachlorometa cresol	59-50-7	SW-846-8270	0.006	nd
2-Methylnaphthalene	91-57-6	SW-846-8270	0.005	nd
Hexachlorocyclopentadiene	77-47-4	SW-846-8270	0.002	nd
2,4,6-trichlorophenol	88-06-2	SW-846-8270	0.008	nd
2,4,5-trichlorophenol	95-95-4	SW-846-8270	0.005	nd
2-chloronaphthalene	91-58-7	SW-846-8270	0.002	nd
2-nitroaniline	88-74-4	SW-846-8270	0.005	nd
Dimethyl phthalate	131-11-3	SW-846-8270	0.002	nd
Acenaphthylene	208-96-8	SW-846-8270	0.002	nd
2,6-Dinitrotoluene	606-20-2	SW-846-8270	0.002	nd
3-nitroaniline	99-09-2	SW-846-8270	0.005	nd
Acenaphthene	83-32-9	SW-846-8270	0.002	nd
2,4-dinitrophenol	51-28-5	SW-846-8270	0.003	nd
4-nitrophenol	100-02-7	SW-846-8270	0.005	nd
Dibenzofuran	132-64-9	SW-846-8270	0.005	nd
2,4-dinitrotoluene	121-14-2	SW-846-8270	0.003	nd
Diethylphthalate	84-66-2	SW-846-8270	0.003	nd
4-chlorophenyl phenyl ether	7005-72-3	SW-846-8270	0.002	nd
Fluorene	86-73-7	SW-846-8270	0.002	nd
4-Nitroaniline	100-01-6	SW-846-8270	0.009	nd
4,6-dinitro-o-cresol	534-52-1	SW-846-8270	0.003	nd
N-nitrosodiphenylamine	86-30-6	SW-846-8270	0.002	nd
4-bromophenyl phenyl ether	101-55-3	SW-846-8270	0.002	nd

**HIGH TECHNOLOGY LABORATORY, INC.**

P.O. Box 366950, San Juan, PR 00936-6950

Tel. (809) 793-7288 ; Fax 792-9280



Report No. 95-1334

Page 25

**Semivolatile Organics Analysis Report**  
for  
**Target Compound List (TCL)**

Sample ID: Field Blank

IITL Sample No. 95-1334-03

Parameter	CAS Number	EPA Method of Analysis	RL (ppm)	Amount (ppm)
Hexachlorobenzene	118-74-1	SW-846-8270	0.005	nd
Pentachlorophenol	87-86-5	SW-846-8270	0.003	nd
Phenanthrene	85-01-8	SW-846-8270	0.002	nd
Anthracene	120-12-7	SW-846-8270	0.002	nd
Carbazole	86-74-8	SW-846-8270	0.005	nd
Di-n-butyl phthalate	84-74-2	SW-846-8270	0.002	0.014
Fluoranthene	206-44-0	SW-846-8270	0.002	nd
Pyrene	129-00-0	SW-846-8270	0.002	nd
Butyl benzyl phthalate	85-68-7	SW-846-8270	0.002	nd
3,3'-dichlorobenzidine	91-94-1	SW-846-8270	0.002	nd
Benzo(a)anthracene	56-55-3	SW-846-8270	0.002	nd
Chrysene	218-01-9	SW-846-8270	0.002	nd
Bis (2-ethylhexyl) phthalate	117-81-7	SW-846-8270	0.002	0.003
Di-n-octyl phthalate	117-84-0	SW-846-8270	0.002	nd
Benzo(b)fluoranthene	205-99-2	SW-846-8270	0.002	nd
Benzo(k)fluoranthene	207-08-9	SW-846-8270	0.002	nd
Benzo(a)pyrene	50-32-8	SW-846-8270	0.002	nd
Indeno(1,2,3-cd)pyrene	193-39-5	SW-846-8270	0.002	nd
Dibenzo(a,h)anthracene	53-70-3	SW-846-8270	0.002	nd
Benzo(ghi)perylene	191-24-2	SW-846-8270	0.002	nd

nd = non-detected (if present concentration below detection limit)

RL = Reporting Limit

ppm = Parts Per Million = milligrams per liter (liquids) or milligrams per kilogram (solids)



**HIGH TECHNOLOGY LABORATORY, INC.**

P.O. Box 366950, San Juan, PR 00936-6950

Tel. (809) 793-7288 ; Fax 792-9280

Report No. 95-1334

Page 26

# Pesticides & PCB's Analysis Report

for  
Target Compound List (TCL)

HTL Sample

95-1334-03

<b>Sample ID:</b>	Field Blank	<b>Date Sampled:</b>	October 3, 1995
<b>Sample Matrix:</b>	Aqueous	<b>Sampled by:</b>	F. Asmar/H. Cancel
<b>Sample wt/vol:</b>	500 mL of TCLP Extract	<b>Date Received:</b>	October 3, 1995
<b>Dilution Factor:</b>	1000	<b>TCLP Extraction:</b>	October 4, 1995
<b>Level (low/med):</b>	Low	<b>Date Extracted:</b>	October 4, 1995
<b>Extr. method:</b>	SW-846-3510	<b>Date Analyzed:</b>	October 7, 1995
<b>Analysis Method:</b>	SW-846-8270	<b>QC-Batch:</b>	95-050

Parameter	CAS Number	EPA Method of Analysis	RL (ppm)	Amount (ppm)
Alpha-BHC	319-84-6	SW-846-8270	0.003	nd
Beta-BHC	319-85-7	SW-846-8270	0.003	nd
Delta-BHC	319-86-8	SW-846-8270	0.003	nd
Gamma-BHC (Lindane)	58-89-9	SW-846-8270	0.003	nd
Heptachlor	76-44-8	SW-846-8270	0.003	nd
Aldrin	309-00-2	SW-846-8270	0.003	nd
Heptachlor epoxide	1024-57-3	SW-846-8270	0.003	nd
Alpha-Endosulfan	959-98-8	SW-846-8270	0.006	nd
Dieldrin	60-57-1	SW-846-8270	0.006	nd
4,4-DDE	72-55-9	SW-846-8270	0.006	nd
Endrin	72-20-8	SW-846-8270	0.006	nd
Beta-Endosulfan	33212-65-9	SW-846-8270	0.006	nd
4,4-DDT	50-29-3	SW-846-8270	0.002	nd
Methoxychlor	72-43-5	SW-846-8270	0.002	nd
Endrin Ketone	53494-70-5	SW-846-8270	0.002	nd
Endrin aldehyde	7421-93-4	SW-846-8270	0.002	nd
Alpha-Chlordane	5103-71-9	SW-846-8270	0.005	nd

**HIGH TECHNOLOGY LABORATORY, INC.**

P.O. Box 366950, San Juan, PR 00936-6950  
Tel. (809) 793-7288 ; Fax 792-9280



Report No. 95-1334  
Page 27

***Pesticides & PCB's Analysis Report***  
*for*  
***Target Compound List (TCL)***

Sample ID: Field Blank

HTL Sample No. 95-1334-03

Parameter	CAS Number	EPA Method of Analysis	RL (ppm)	Amount (ppm)
Gamma-Chlordane	5103-74-2	SW-846-8270	0.005	nd
Toxaphene	8001-35-2	SW-846-8270	0.005	nd
PCB-1016	12674-11-2	SW-846-8270	0.005	nd
PCB-1221	11104-28-2	SW-846-8270	0.005	nd
PCB-1232	11141-16-5	SW-846-8270	0.005	nd
PCB-1242	53469-21-9	SW-846-8270	0.005	nd
PCB-1248	12672-29-6	SW-846-8270	0.005	nd
PCB-1254	11097-69-1	SW-846-8270	0.005	nd
PCB-1260	11096-82-5	SW-846-8270	0.005	nd

nd = non-detected (if present concentration below detection limit)

RL = Reporting Limit

ppm = Parts Per Million = milligrams per liter (liquids) or milligrams per kilogram (solids)



***HIGH TECHNOLOGY LABORATORY, INC.***

P.O. Box 366950, San Juan, PR 00936-6950

Tel. (809) 793-7288 ; Fax 792-9280

Report No. 95-1334

Page 28

# Metals Analysis Report

for  
Inorganic Target Analyte List (TAL)

HTL Sample

95-1334-03

<b>Sample ID:</b>	Field Blank	<b>Date Sampled:</b>	October 3, 1995
<b>Sample Matrix:</b>	Aqueous	<b>Sampled by:</b>	F. Asmar/H. Cancel
<b>Sample wt/vol:</b>	25.0 mL of TCLP Extract	<b>Date Received:</b>	October 3, 1995
<b>Dilution Factor:</b>	2.0	<b>TCLP Extraction:</b>	October 4, 1995
<b>Level (low/med):</b>	Low	<b>Date Digested:</b>	October 4, 1995
<b>Digestion method:</b>	SW-846-3015	<b>Date Analyzed:</b>	October 9 to 11, 1995
<b>Analysis Method:</b>	SW-846-6010	<b>QC-Batch:</b>	95-158

Parameter	CAS Number	EPA Method	RL (ppm)	Amount (ppm)
Aluminum	7429-90-5	3120B	0.011	0.180
Antimony	7440-36-0	3120B	0.011	nd
Arsenic	7440-38-2	3120B	0.010	nd
Barium	7440-39-3	3120B	0.001	nd
Beryllium	7440-41-7	3120B	0.001	nd
Cadmium	7440-43-9	3120B	0.001	nd
Calcium	7440-70-2	3120B	0.011	0.868
Chromium	7440-47-3	3120B	0.001	nd
Cobalt	7440-48-4	3120B	0.001	nd
Copper	7440-50-8	3120B	0.007	nd
Iron	7439-89-6	3120B	0.001	0.104
Lead	7439-92-1	3120B	0.005	nd
Magnesium	7439-95-4	3120B	0.003	0.275
Manganese	7439-96-5	3120B	0.001	0.005
Mercury	7439-97-6	3112B	0.002	nd
Nickel	7440-02-0	3120B	0.001	nd
Potassium	7440-09-7	3120B	0.006	0.395

**HIGH TECHNOLOGY LABORATORY, INC.**

P.O. Box 366950, San Juan, PR 00936-6950  
Tel. (809) 793-7288 ; Fax 792-9280



Report No. 95-1334

Page 29

**Metals Analysis Report**  
*for*  
**Inorganic Target Analyte List (TCL)**

Sample ID: Field Blank

HTL Sample No. 95-1334-03

Parameter	CAS Number	EPA Method	RL (ppm)	Amount (ppm)
Selenium	7782-49-2	3120B	0.013	nd
Silver	7440-22-4	3120B	0.001	nd
Sodium	7440-23-5	3120B	0.061	2.56
Thallium	7440-28-0	3120B	0.023	nd
Vanadium	7440-62-2	3120B	0.001	nd
Zinc	7440-66-6	3120B	0.009	nd

nd = non-detected (if present concentration below detection limit)

RL = Reporting Limit

ppm = Parts Per Million = milligrams per liter (liquids) or milligrams per kilogram (solids)



# Volatile Organics Analysis Report

for  
Target Compound List (TCL)

HTL Sample

95-1334-04

Sample ID:	Trip Blank	Date Sampled:	October 3, 1995
Sample Matrix:	Aqueous	Sampled by:	F. Asmar/H. Cancel
Sample wt/vol:	5 mL of TCLP Extract	Date Received:	October 3, 1995
Dilution Factor:	1	TCLP Extraction:	October 4, 1995
Level (low/med):	Low	Date Analyzed:	October 6, 1995
Prep. method:	SW-846-5030	QC-Batch:	95-116
Analysis Method:	SW-846-8260		

Parameter	CAS Number	EPA Method of Analysis	RL (ppm)	Amount (ppm)
Chloromethane	74-87-3	SW-846-8260	0.002	nd
Bromomethane	74-83-9	SW-846-8260	0.004	nd
Vinyl chloride	75-01-4	SW-846-8260	0.005	nd
Chloroethane	75-00-3	SW-846-8260	0.002	nd
Methylene chloride	75-09-2	SW-846-8260	0.008	0.278
Acetone	67-64-1	SW-846-8260	0.010	nd
Carbon Disulfide	75-15-0	SW-846-8260	0.010	nd
1,1-Dichloroethene	75-35-4	SW-846-8260	0.004	nd
1,1-Dichloroethane	75-34-3	SW-846-8260	0.002	nd
1,2-Dichloroethene (total)	540-59-0	SW-846-8260	0.010	nd
Chloroform	67-66-3	SW-846-8260	0.002	0.300
1,2-Dichloroethane	107-06-2	SW-846-8260	0.003	nd
2-Butanone	78-93-3	SW-846-8260	0.010	nd
1,1,1-Trichloroethane	71-55-6	SW-846-8260	0.001	nd
Carbon Tetrachloride	56-23-5	SW-846-8260	0.003	nd
Bromodichloromethane	75-27-4	SW-846-8260	0.003	nd
1,2-Dichloropropane	78-87-5	SW-846-8260	0.001	nd
cis-1,3-Dichloropropene	10061-01-5	SW-846-8260	0.010	nd

**HIGH TECHNOLOGY LABORATORY, INC.**

P.O. Box 366950, San Juan, PR 00936-6950

Tel. (809) 793-7288 ; Fax 792-9280



Report No. 95-1334

Page 31

# Volatile Organics Analysis Report

## for

### Target Compound List (TCL)

Sample ID: Trip Blank

HTL Sample No.95-1334-04

Parameter	CAS Number	EPA Method of Analysis	RL (ppm)	Amount (ppm)
Trichloroethene	79-01-6	SW-846-8260	0.003	nd
Dibromochloromethane	124-48-1	SW-846-8260	0.003	nd
1,1,2-Trichloroethane	79-00-5	SW-846-8260	0.001	nd
Benzene	71-43-2	SW-846-8260	0.005	nd
trans-1,3-Dichloropropene	10061-02-6	SW-846-8260	0.001	nd
Bromoform	75-25-2	SW-846-8260	0.006	nd
4-Methyl-2-Pentanone	108-10-1	SW-846-8260	0.010	nd
2-Hexanone	591-78-6	SW-846-8260	0.001	nd
Tetrachloroethene	127-18-4	SW-846-8260	0.001	nd
Toluene	108-88-3	SW-846-8260	0.005	0.042
1,1,2,2-Tetrachloroethane	79-34-5	SW-846-8260	0.005	nd
Chlorobenzene	108-90-7	SW-846-8260	0.005	nd
Ethylbenzene	100-41-4	SW-846-8260	0.005	nd
Styrene	100-42-5	SW-846-8260	0.005	nd
Xylenes (Total)	1330-20-7	SW-846-8260	0.010	nd
1,2-Dichlorobenzene	95-50-1	SW-846-8260	0.002	nd
1,3-Dichlorobenzene	541-73-1	SW-846-8260	0.002	nd
1,4-Dichlorobenzene	106-46-7	SW-846-8260	0.002	nd

nd = non-detected (if present concentration below detection limit)

RL = Reporting Limit

ppm = Parts Per Million = milligrams per liter (liquids) or milligrams per kilogram (solids)



**HIGH TECHNOLOGY LABORATORY, INC.**

P.O. Box 366950, San Juan, PR 00936-6950

Tel. (809) 793-7288 ; Fax 792-9280

Report No. 95-1334

Page 32

# Semivolatile Organics Analysis Report

for  
Target Compound List (TCL)

HTL Sample

95-1334-04

Sample ID:	Trip Blank	Date Sampled:	October 3, 1995
Sample Matrix:	Aqueous	Sampled by:	F. Asmar/H. Cancel
Sample wt/vol:	500 mL of TCLP Extract	Date Received:	October 3, 1995
Dilution Factor:	1000	TCLP Extraction:	October 4, 1995
Level (low/med):	Low	Date Extracted:	October 4, 1995
Extr. method:	SW-846-3510	Date Analyzed:	October 7, 1995
Analysis Method:	SW-846-8270	QC-Batch:	95-050

Parameter	CAS Number	EPA Method of Analysis	RL (ppm)	Amount (ppm)
Phenol	108-95-2	SW-846-8270	0.006	nd
Bis (2-chloroethyl) ether	111-44-4	SW-846-8270	0.003	nd
2-chlorophenol	95-57-8	SW-846-8270	0.003	nd
2-Methylphenol	95-48-7	SW-846-8270	0.006	nd
Bis (2-chloroisopropyl) ether	108-60-1	SW-846-8270	0.002	nd
4-Methylphenol	106-44-5	SW-846-8270	0.006	nd
N-nitroso-di-n-propylamine	621-64-7	SW-846-8270	0.003	nd
Hexachloroethane	67-72-1	SW-846-8270	0.002	nd
Nitrobenzene	98-95-3	SW-846-8270	0.003	nd
Isophorone	78-59-1	SW-846-8270	0.003	nd
2-nitrophenol	88-75-5	SW-846-8270	0.003	nd
2,4-dimethylphenol	105-67-9	SW-846-8270	0.003	nd
Bis (2-chloroethoxy) methane	111-91-1	SW-846-8270	0.006	nd
2,4-dichlorophenol	120-83-2	SW-846-8270	0.006	nd
1,2,4-trichlorobenzene	120-82-1	SW-846-8270	0.002	nd
Naphthalene	91-20-3	SW-846-8270	0.002	nd
4-Chloroaniline	106-47-8	SW-846-8270	0.005	nd

**HIGH TECHNOLOGY LABORATORY, INC.**

P.O. Box 366950, San Juan, PR 00936-6950  
Tel. (809) 793-7288 ; Fax 792-9280



Report No. 95-1334  
Page 33

*Semivolatile Organics Analysis Report*  
for  
*Target Compound List (TCL)*

Sample ID: Trip Blank

HTL Sample No. 95-1334-04

Parameter	CAS Number	EPA Method of Analysis	RL (ppm)	Amount (ppm)
Hexachlorobutadiene	87-68-3	SW-846-8270	0.002	nd
Parachlorometa cresol	59-50-7	SW-846-8270	0.006	nd
2-Methylnaphthalene	91-57-6	SW-846-8270	0.005	nd
Hexachlorocyclopentadiene	77-47-4	SW-846-8270	0.002	nd
2,4,6-trichlorophenol	88-06-2	SW-846-8270	0.008	nd
2,4,5-trichlorophenol	95-95-4	SW-846-8270	0.005	nd
2-chloronaphthalene	91-58-7	SW-846-8270	0.002	nd
2-nitroaniline	88-74-4	SW-846-8270	0.005	nd
Dimethyl phthalate	131-11-3	SW-846-8270	0.002	nd
Acenaphthylene	208-96-8	SW-846-8270	0.002	nd
2,6-Dinitrotoluene	606-20-2	SW-846-8270	0.002	nd
3-nitroaniline	99-09-2	SW-846-8270	0.005	nd
Acenaphthene	83-32-9	SW-846-8270	0.002	nd
2,4-dinitrophenol	51-28-5	SW-846-8270	0.003	nd
4-nitrophenol	100-02-7	SW-846-8270	0.005	nd
Dibenzofuran	132-64-9	SW-846-8270	0.005	nd
2,4-dinitrotoluene	121-14-2	SW-846-8270	0.003	nd
Diethylphthalate	84-66-2	SW-846-8270	0.003	nd
4-chlorophenyl phenyl ether	7005-72-3	SW-846-8270	0.002	nd
Fluorene	86-73-7	SW-846-8270	0.002	nd
4-Nitroaniline	100-01-6	SW-846-8270	0.009	nd
4,6-dinitro-o-cresol	534-52-1	SW-846-8270	0.003	nd
N-nitrosodiphenylamine	86-30-6	SW-846-8270	0.002	nd
4-bromophenyl phenyl ether	101-55-2	SW-846-8270	0.002	nd

**HIGH TECHNOLOGY LABORATORY, INC.**

P.O. Box 366950, San Juan, PR 00936-6950

Tel. (809) 793-7288 ; Fax 792-9280



Report No. 95-1334

Page 34

**Semivolatile Organics Analysis Report**  
for  
**Target Compound List (TCL)**

Sample ID: Trip Blank

HTL Sample No. 95-1334-04

Parameter	CAS Number	EPA Method of Analysis	RL (ppm)	Amount (ppm)
Hexachlorobenzene	118-74-1	SW-846-8270	0.005	nd
Pentachlorophenol	87-86-5	SW-846-8270	0.003	nd
Phenanthrene	85-01-8	SW-846-8270	0.002	nd
Anthracene	120-12-7	SW-846-8270	0.002	nd
Carbazole	86-74-8	SW-846-8270	0.005	nd
Di-n-butyl phthalate	84-74-2	SW-846-8270	0.002	0.009
Fluoranthene	206-44-0	SW-846-8270	0.002	nd
Pyrene	129-00-0	SW-846-8270	0.002	nd
Butyl benzyl phthalate	85-68-7	SW-846-8270	0.002	nd
3,3'-dichlorobenzidine	91-94-1	SW-846-8270	0.002	nd
Benzo(a)anthracene	56-55-3	SW-846-8270	0.002	nd
Chrysene	218-01-9	SW-846-8270	0.002	nd
Bis (2-ethylhexyl) phthalate	117-81-7	SW-846-8270	0.002	0.003
Di-n-octyl phthalate	117-84-0	SW-846-8270	0.002	nd
Benzo(b)fluoranthene	205-99-2	SW-846-8270	0.002	nd
Benzo(k)fluoranthene	207-08-9	SW-846-8270	0.002	nd
Benzo(a)pyrene	50-32-8	SW-846-8270	0.002	nd
Indeno(1,2,3-cd)pyrene	193-39-5	SW-846-8270	0.002	nd
Dibenzo(a,h)anthracene	53-70-3	SW-846-8270	0.002	nd
Benzo(ghi)perylene	191-24-2	SW-846-8270	0.002	nd

nd = non-detected (if present concentration below detection limit)

RL = Reporting Limit

ppm = Parts Per Million = milligrams per liter (liquids) or milligrams per gram (solids)



**HIGH TECHNOLOGY LABORATORY, INC.**

P.O. Box 366950, San Juan, PR 00936-6950

Tel. (809) 793-7288 ; Fax 792-9280

Report No. 95-1334

Page 35

# Pesticides & PCB's Analysis Report

for  
Target Compound List (TCL)

HTL Sample

95-1334-04

Sample ID:	Trip Blank	Date Sampled:	October 3, 1995
Sample Matrix:	Aqueous	Sampled by:	F. Asmar/H. Cancel
Sample wt/vol:	500 mL of TCLP Extract	Date Received:	October 3, 1995
Dilution Factor:	1000	TCLP Extraction:	October 4, 1995
Level (low/med):	Low	Date Extracted:	October 10, 1995
Extr. method:	SW-846-3510	Date Analyzed:	October 11, 1995
Analysis Method:	SW-846-8270	QC-Batch:	95-052

Parameter	CAS Number	EPA Method of Analysis	RL (ppm)	Amount (ppm)
Alpha-BHC	319-84-6	SW-846-8270	0.003	nd
Beta-BHC	319-85-7	SW-846-8270	0.003	nd
Delta-BHC	319-86-8	SW-846-8270	0.003	nd
Gamma-BHC (Lindane)	58-89-9	SW-846-8270	0.003	nd
Heptachlor	76-44-8	SW-846-8270	0.003	nd
Aldrin	309-00-2	SW-846-8270	0.003	nd
Heptachlor epoxide	1024-57-3	SW-846-8270	0.003	nd
Alpha-Endosulfan	959-98-8	SW-846-8270	0.006	nd
Dieldrin	60-57-1	SW-846-8270	0.006	nd
4,4-DDE	72-55-9	SW-846-8270	0.006	nd
Endrin	72-20-8	SW-846-8270	0.006	nd
Beta-Endosulfan	33212-65-9	SW-846-8270	0.006	nd
4,4-DDT	50-29-3	SW-846-8270	0.002	nd
Methoxychlor	72-43-5	SW-846-8270	0.002	nd
Endrin Ketone	53494-70-5	SW-846-8270	0.002	nd
Endrin aldehyde	7421-93-4	SW-846-8270	0.002	nd
Alpha-Chlordane	5103-71-9	SW-846-8270	0.005	nd

**HIGH TECHNOLOGY LABORATORY, INC.**

P.O. Box 366950, San Juan, PR 00936-6950

Tel. (809) 793-7288 ; Fax 792-9280



Report No. 95-1334

Page 36

*Pesticides & PCB's Analysis Report*  
*for*  
*Target Compound List (TCL)*

Sample ID: Trip Blank

HTL Sample No. 95-1334-04

Parameter	CAS Number	EPA Method of Analysis	RL (ppm)	Amount (ppm)
Gamma-Chlordane	5103-74-2	SW-846-8270	0.005	nd
Toxaphene	8001-35-2	SW-846-8270	0.005	nd
PCB-1016	12674-11-2	SW-846-8270	0.005	nd
PCB-1221	11104-28-2	SW-846-8270	0.005	nd
PCB-1232	11141-16-5	SW-846-8270	0.005	nd
PCB-1242	53469-21-9	SW-846-8270	0.005	nd
PCB-1248	12672-29-6	SW-846-8270	0.005	nd
PCB-1254	11097-69-1	SW-846-8270	0.005	nd
PCB-1260	11096-82-5	SW-846-8270	0.005	nd

nd = non-detected (if present concentration below detection limit)

RL = Reporting Limit

ppm = Parts Per Million = milligrams per liter (liquids) or milligrams per kilogram (solids)



**HIGH TECHNOLOGY LABORATORY, INC.**

P.O. Box 366950, San Juan, PR 00936-6950

Tel. (809) 793-7288 ; Fax 792-9280

Report No. 95-1334

Page 37

# Metals Analysis Report

for  
Inorganic Target Analyte List (TAL)

HTL Sample

95-1334-04

Sample ID: Trip Blank  
Sample Matrix: Aqueous  
Sample wt/vol: 25.0 mL of TCLP Extract  
Dilution Factor: 2.0  
Level (low/med): Low  
Digestion method: SW-846-3015  
Analysis Method: SW-846-6010

Date Sampled: October 3, 1995  
Sampled by: F. Asmar/H. Cancel  
Date Received: October 3, 1995  
TCLP Extraction: October 4, 1995  
Date Digested: October 4, 1995  
Date Analyzed: October 9 to 11, 1995  
QC-Batch: 95-158

Parameter	CAS Number	EPA Method	RL (ppm)	Amount (ppm)
Aluminum	7429-90-5	3120B	0.011	nd
Antimony	7440-36-0	3120B	0.011	nd
Arsenic	7440-38-2	3120B	0.010	nd
Barium	7440-39-3	3120B	0.001	nd
Beryllium	7440-41-7	3120B	0.001	nd
Cadmium	7440-43-9	3120B	0.001	nd
Calcium	7440-70-2	3120B	0.011	0.153
Chromium	7440-47-3	3120B	0.001	nd
Cobalt	7440-48-4	3120B	0.001	nd
Copper	7440-50-8	3120B	0.007	nd
Iron	7439-89-6	3120B	0.001	nd
Lead	7439-92-1	3120B	0.005	nd
Magnesium	7439-95-4	3120B	0.003	0.199
Manganese	7439-96-5	3120B	0.001	nd
Mercury	7439-97-6	3112B	0.002	nd
Nickel	7440-02-0	3120B	0.001	nd
Potassium	7440-09-7	3120B	0.006	0.377

HIGH TECHNOLOGY LABORATORY, INC.

P.O. Box 366950, San Juan, PR 00936-6950

Tel. (809) 793-7288 ; Fax 792-9280



Report No. 95-1334

Page 38

***Metals Analysis Report***  
***for***  
***Inorganic Target Analyte List (TCL)***

Sample ID: Trip Blank

HTL Sample No. 95-1334-04

Parameter	CAS Number	EPA Method	RL (ppm)	Amount (ppm)
Selenium	7782-49-2	3120B	0.013	nd
Silver	7440-22-4	3120B	0.001	nd
Sodium	7440-23-5	3120B	0.061	1.98
Thallium	7440-28-0	3120B	0.023	nd
Vanadium	7440-62-2	3120B	0.001	nd
Zinc	7440-66-6	3120B	0.009	nd

nd = non-detected (if present concentration below detection limit)

RL = Reporting Limit

ppm = Parts Per Million = milligrams per liter (liquids) or milligrams per kilogram (solids)



***HIGH TECHNOLOGY LABORATORY, INC.***

P.O. Box 366950, San Juan, PR 00936-6950

Tel. (809) 793-7288 ; Fax 792-9280

Report No. 95-1334

Page 39



QUANTUM LABORATORIES, INC.  
ENVIRONMENTAL AND ANALYTICAL SERVICES  
P.O. BOX 366950 SAN JUAN, PR 00936-6950

TEL. (809) 793-7288

FAX (809) 792-9280

# CHAIN OF CUSTODY

ORDER

NORMAL

SERVICE  
ORDER NO

15-1334 05832

COMPANY  
SERVICED

CLIENT NAME

CODE

SAMPLERS  
NAME

DRUSH (48 HOURS)

DRUSH (24 HOURS)

THERE ARE  
ADDITIONAL  
CHARGES FOR  
RUSH ORDERS

WITNESS  
NAME

SIGN

DATE

TIME

SPECIAL  
NOTE

PROJECT NAME: Sampling Oil Lagoon Unit #9

SAMPLING LOCATION: Protero Facilities (Oil Lagoon Unit #9)

CONTACT PERSON: Rene Rodriguez TEL:

FIELD NO. CL NO. DESC IDENTIFICATION/SOURCE T

SAMPLING DATE 2

SAMPLING HOUR 2

SAMPLING DATE 1

SAMPLING HOUR 1

FIELD PH (STD UNIT)

FIELD TEMP C

PURCHASE ORDER NO.

PARAMETERS / PRESERVATIVES

QUOTATION NUMBER

PRODUCT  
NUMBER

95-1334-01 Soil Sample Oil Lagoon

95-1334-02 Trip Blank

95-1334-03 Trip Blank

95-1334-04 Trip Blank

G C	AL	G C	Cu	G C	Se	G C	CYAN	G C	SSmg/L	G C	ADMI (COLOR)	G C	Mg
G C	As	G C	Fe	G C	Sn	G C	PHEN	G C	SULFIDE	G C	PI-CO (COLOR)	G C	Na
G C	Ag	G C	Hg	G C	Zn	G C	FLASH	G C	MBAS	G C	SO4	G C	K
G C	Ba	G C	Mn	G C	BOD	G C	TDS	G C	NH3	G C	NO3	G C	CL
G C	Ca	G C	N	G C	COD	G C	TSS	G C	TKN	G C	NO3-NO2	G C	HARD
G C	Co	G C	Pb	G C	O&G	G C	SSm/L	G C	T-Phos	G C	Ca	G C	ALK

NOTES

RELINQUISHED: (NAME / SIGN)

DATE/TIME

RECEIVED BY (NAME / SIGN)

DATE/TIME

RECEIVED AT LABORATORY (NAME / SIGN)

SAM  
CO

TRANSPORTATION

**APPENDIX C**  
**TREATABILITY STUDY**



**OHM Remediation  
Services Corp.**

A Subsidiary of OHM Corporation

STABILIZATION/SOLIDIFICATION TREATABILITY  
TESTING REPORT FOR THE  
HAZARDOUS WASTE UNIT #9 SLUDGE AT  
PROTECCION TECNICA ECOLOGICA, INC.  
PENUELAS, PUERTO RICO

Prepared for:

Protección Técnica Ecológica, Inc.  
P.O. Box 71331  
San Juan, Puerto Rico  
00936-8431

Prepared by:

Paul R. Lear  
OHM Remediation Services Corp.  
Findlay, OH

November 2, 1995  
OHM Project 18146

## SECTION 2.0

# STABILIZATION TREATABILITY TESTING

### 2.1 Task I - Waste Characterization

OHM'S Treatability Laboratory received the 5 gallon composite sample of clay-solidified bottom sludge material on October 9, 1995. The sample was thoroughly homogenized and portions of the homogenized sample material were analyzed for the parameters listed in Table 1. Care was taken to minimize sampling bias.

Table 1. Characterization Data - Physical Testing

Parameter	Methodology	
pH	SW-846 Method 9045	7.38
Bulk Density	ASTM Method D2937	88.0 lb/ft <sup>3</sup>
Moisture Content	ASTM Method D2166	25.2%

Note: Moisture content calculated on a wet weight basis  $[(\text{weight water})/(\text{total weight})]$

These characterization values were similar to those determined in the earlier treatability testing conducted by OHM.

### 2.2 Task II - Stabilization/Solidification Screening

Portions (~500 g) of the waste sludge sample were mixed with Portland cement or cement kiln dust at tow mix ratios: 0.05 and 0.10. Mix ratio is defined as the weight of reagent divided by the weight of waste. The addition of water to each formulation was not required to ensure sufficient mixing of the waste material and the stabilization reagent(s). All formulations were mixed using a planetary mixer operating at 30-40 rpm for 45 to 60 seconds. The treated material from all formulations was compacted into a 2"x4" right cylinder molds and cured at 95% relative humidity and ambient temperature. After 7 days of curing, the treated material were subjected to unconfined compressive strength testing (Table 2).



Table 2. Strength Development for the Stabilization/Solidification Formulations

Formulation	Portland Cement Mix Ratio	Cement Kiln Dust Mix Ratio	UCS (psi)
1	0.05		66.7
2	0.10		68.8
3		0.5	72.2
4		0.10	104

$$\text{Mix Ratio} = [(\text{weight reagent})/(\text{weight waste})]$$

### 2.3 Task III - Leach Testing

Since the 0.05 mix ratio Portland cement formulation had an unconfined compressive strength value of greater than 12 psi after 7 days of curing, it was selected for total and TCLP analysis. The total analysis results for sample P-1B are summarized in Table 3 through 6. These results indicated that trace levels of toluene, bis(2-ethylhexyl)phthalate, 2-methylnaphthalene, naphthalene, phenanthrene, phenol, and pyrene were found in the stabilized material, along with low levels of barium, chromium, lead, nickel, vanadium, and zinc. Lower detection limits for the semi-volatile organics would not be possible due to the amount of non-identified contamination present in the extracts of the stabilized material. A slightly lower detection limit for the volatile organics may have been possible, but is also limited by the amount of purgable, non-identified contamination present.

Analysis of the TCLP leachate from stabilized material (sample P-1A) for the leachable concentrations of contaminants on the Target Analyte List (TAL) (Table 7 through 10) indicated that trace levels of methylene chloride, toluene, 2,4-dimethylphenol, naphthalene, and dieldrin were found, along with low levels of barium, molybdenum, nickel, vanadium, and zinc. Detection limits were again affected by the presence of non-identified organic contamination.

Table 3. Solidified Material Total VOCs Content

Parameter	Result (mg/kg)	Parameter	Result (mg/kg)
Acetone	<24.3	trans-1,3-Dichloropropylene	<12.1
Acrolein	<60.7	Ethylbenzene	<12.1
Acrylonitrile	<30.3	Ethyl Acetate	<48.5
Benzene	<12.1	Methyl Bromide	<12.1
Bromoform	<12.1	Methyl Chloride	<12.1
Carbon Tetrachloride	<12.1	Methylene Chloride	<12.1
Chlorobenzene	<12.1	1,1,2,2-Tetrachloroethane	<12.1
Chlorodibromomethane	<12.1	Tetrachloroethylene	<12.1
Chloroethane	<12.1	Toluene	21.8
Chloroform	<12.1	1,1,1-Trichloroethane	<12.1
2-Chloroethylvinyl ether	<12.1	1,1,2-Trichlorethane	<12.1
Dichlorobromomethane	<12.1	Trichloroethylene	<12.1
1,1-Dichloroethane	<12.1	Trichlorofluoromethane	<12.1
1,2-Dichloroethane	<12.1	1,2-trans-Dichlorethylene	<12.1
1,1-Dichloroethylene	<12.1	1,1,2-Trichlorotrifluorethane	<12.1
1,2-Dichloropropane	<12.1	Vinyl Chloride	<12.1
cis-1.3-Dichloropropylene	<12.1	Xylenes	<12.1

STABILIZATION TREATABILITY TESTING

Table 4. Stabilized Material Total Semivolatiles Content

Parameter	Result (mg/kg)	Parameter	Result (mg/kg)	Parameter	Result (mg/kg)
Acenaphthene	<4.00	Chrysene	4.84	Hexachlorocyclopentadiene	<4.00
Acenaphthylene	<4.00	Dibenzo(a,h)anthracene	<4.00	Hexachloroethane	<4.00
Anthracene	<4.00	Dibenzofuran	<4.00	Indeno (1,2,3-c,d)pyrene	<4.00
Benidine	<4.00	Di-n-butyl Phthalate	<4.00	Isophorone	<4.00
Benzo(a)anthracene	<4.00	Di-n-octyl Phthalate	<4.00	2-Methylnaphthalene	22.7
Benzo(b)fluoranthene	<4.00	1,2-Dichlorobenzene	<4.00	2-Methylphenol	<4.00
Benzo(k)fluoranthene	<4.00	1,3-Dichlorobenzene	<4.00	4-Methylphenol	<4.00
Benzo(ghi)perylene	<4.00	1,4-Dichlorobenzene	<4.00	N-Nitrosodiethylamine	<4.00
Benzo(a)pyrene	<4.00	3,3'-Dichlorobenzidine	<4.00	N-Nitrosodi-n-propylamine	<4.00
bis (2-Chloroethoxy)methane	<4.00	2,4-Dichlorophenol	<4.00	N-Nitrosodiphenylamine	<4.00
bis (2-Chloroethyl)ether	<4.00	Diethyl Phthalate	<4.00	Naphthalene	8.56
bis(2-Chloroisopropyl)ether	<4.00	Dimethyl Phthalate	<4.00	Nitrobenzene	<4.00
bis(2-Ethylhexyl)phthalate	12.4	2,4-Dimethylphenol	<4.00	2-Nitrophenol	<4.00
4-Bromophenyl Phenyl Ether	<4.00	4,6-Dinitro-o-cresol	<10.0	4-Nitrophenol	<20.0
Butyl Benzyl Phthalate	<4.00	2,4-Dinitrophenol	<20.0	Pentachlorophenol	<4.00
Carbazole	<4.00	2,4-Dinitrotoluene	<4.00	Phenanthrene	19.6
4-Chloroaniline	<4.00	2,6-Dinitrotoluene	<4.00	Phenol	4.04
p-Chloro-m-cresol	<4.00	Fluoranthene	<4.00	Pyrene	6.44
2-Chloronaphthalene	<4.00	Fluorene	<4.00	Pyridine	<4.00
2-Chlorophenol	<4.00	Hexachlorobenzene	<4.00	1,2,4-Trichlorobenzene	<4.00
4-Chlorophenyl Phenyl Ether	<4.00	Hexachlorobutadiene	<4.00	2,4,5-Trichlorophenol	<4.00
				2,4,6-Trichlorophenol	<4.00



Table 5. Stabilized Material Total Metals Content

Parameter	Result (mg/kg)	Parameter	Result (mg/kg)
Aluminum	9950	Magnesium	8920
Antimony	<3.94	Manganese	374
Arsenic	<9.85	Mercury	0.370
Barium	176	Nickel	453
Beryllium	<1.97	Potassium	2290
Cadmium	<1.97	Selenium	<9.85
Calcium	281000	Silver	<1.97
Chromium	125	Sodium	1540
Cobalt	22.0	Thallium	<9.85
Copper	161	Vanadium	1620
Iron	39800	Zinc	303
Lead	143		



Table 6. Stabilized Material Total Herbicides, Pesticides, and PCBs Content

Parameter	Result (mg/kg)	Parameter	Result (mg/kg)
2,4-D	<0.093	Endrin	<0.033
2,4,5-TP	<0.093	Endrin aldehyde	<0.033
Aldrin	<0.033	gamma-BHC	<0.033
alpha-BHC	<0.033	Heptachlor	<0.033
beta-BHC	<0.033	Heptachlor epoxide	<0.033
Chlordane	<0.331	Toxaphene	<0.662
4,4'-DDD	<0.033	Methoxychlor	<0.033
4,4'-DDE	<0.033	Aroclor 1016	<0.331
4,4'-DDT	<0.033	Aroclor 1221	<0.331
delta-BHC	<0.033	Aroclor 1232	<0.331
Dieldrin	<0.033	Aroclor 1242	<0.331
Endosulfan sulfate	<0.033	Aroclor 1248	<0.331
Endosulfan I	<0.033	Aroclor 1254	<0.331
Endosulfan II	<0.033	Aroclor 1260	<0.331



Table 9. Stabilized Material TCLP Metals Content

Parameter	Result (mg/L)	Parameter	Result (mg/L)
Aluminum	<0.100	Magnesium	40.5
Antimony	<0.060	Manganese	0.110
Arsenic	<0.100	Mercury	<0.001
Barium	0.276	Molybdenum	0.248
Beryllium	<0.005	Nickel	0.388
Cadmium	<0.005	Potassium	19.0
Calcium	853	Selenium	<0.100
Chromium	<0.020	Silver	<0.020
Cobalt	<0.020	Sodium	4010
Copper	<0.020	Thallium	<0.100
Iron	<0.100	Vanadium	1.14
Lead	<0.100	Zinc	0.250



Table 10. Stabilized Material TCLP Herbicides, Pesticides, and PCBs Content

Parameter	Result (mg/L)	Parameter	Result (mg/L)
2,4-D	<0.0005	Endrin	<0.0001
2,4,5-TP	<0.0005	Endrin aldehyde	<0.0001
Aldrin	<0.0001	gamma-BHC	0.0001
alpha-BHC	0.0008	Heptachlor	<0.0001
beta-BHC	<0.0001	Heptachlor epoxide	<0.0001
Chlordane	<0.001	Toxaphene	<0.002
4,4'-DDD	<0.0001	Methoxychlor	<0.0001
4,4'-DDE	<0.0001	Aroclor 1016	<0.001
4,4'-DDT	<0.0001	Aroclor 1221	<0.001
delta-BHC	<0.0001	Aroclor 1232	<0.001
Dieldrin	0.0003	Aroclor 1242	<0.001
Endosulfan sulfate	<0.0001	Aroclor 1248	<0.001
Endosulfan I	<0.0001	Aroclor 1254	<0.001
Endosulfan II	<0.0001	Aroclor 1260	<0.001

## SECTION 3.0

# TREATABILITY TESTING CONCLUSIONS

The Hazardous Waste Unit #9 sludge material appears amenable to stabilization. A dry, friable, soil-like treated product can be produced. The unconfined compressive strength of the treated product exceeds the 12 psi required to support heavy construction equipment. Stabilization with a 0.05 mix ratio of Portland cement or a 0.10 mix ratio of cement kiln dust was required to produce an acceptable treated product.

Analysis of the stabilized material for the total concentrations of contaminants on the Target Analyte List (TAL) indicated that trace levels of toluene, bis(2-ethylhexyl)phthalate, 2-methylnaphthalene, naphthalene, phenanthrene, phenol, and pyrene were found, along with low levels of barium, chromium, lead, nickel, vanadium, and zinc.

Analysis of the TCLP leachate from stabilized material for the leachable concentrations of contaminants on the Target Analyte List (TAL) indicated that trace levels of methylene chloride, toluene, 2,4-dimethylphenol, naphthalene, and dieldrin were found, along with low levels of barium, molybdenum, nickel, vanadium, and zinc.

*As with all treatability and laboratory studies, the results of this study were obtained under laboratory conditions using a composite sample. Full scale processing under field conditions and/or variability in the materials to be treated may result in treated material which varies from the treated material produced under laboratory conditions.*



OHM Remediation  
Services Corp.

A Subsidiary of OHM Corporation

## ANALYTICAL DIVISION

Laboratory Analysis

Report(s) #619035

**Client:** OHM Remediation Services Corp.  
TAC Treatability, Findlay, OH

**Attn:** Paul Lear

**Project:** 18146T - Proteco

**Sample(s) Received:** October 16, 1995


**Data Due:** October 23, 1995

**Order Received:** October 16, 1995

**Data Reported:** October 25, 1995

*This report is **"PROPRIETARY AND CONFIDENTIAL"** and delivered to, and intended for the exclusive use of the above named client only. OHM Remediation Services Corp., Analytical Division, assumes no responsibility or liability for the reliance hereon or use hereof by anyone other than the above named client.*

**Reviewed and Approved by:**

  
Thomas E. Gran, Ph.D., Vice President

**Date:** November 2, 1995

## PROJECT NARRATIVE

---

The following items relate to the samples and analytical data contained in this report.

- o The identity of all pesticide and herbicide compounds were confirmed by secondary column analysis.
- o Note any comments at the bottom of the tables in Appendices B and C.
- o Insufficient sample volume was available to perform matrix spikes for Batches #Q7C51523, #Q7H51524 and #Q7P51525. Batch acceptance is based on method spike recoveries.
- o The lowest detection possible was reported for this project.

---

The following relate to the timeliness and completeness of the analytical data reported:

- o Data was reported to Mr. Pat Grine and Mr. Paul Lear on Monday, October 23 and Wednesday, October 25, 1995. All data, except the following, were reported within the required time frame.

PARAMETER	REASON FOR DELAY
Pesticides and Herbicides	Instrument capacity problems.

# SAMPLE INFORMATION SUMMARY

Sample Id	Lab Id	Sample Date	Matrix	Method	QC Batch #	Prep Date	Analysis Date	Hold Met	Run #	Analyst
P-1A	JO9400	10/16/95	Solid	1311		10/16/95	N/A	YES		Lucy R.
			Solid	1311-ZHE		10/16/95	N/A	YES		Lucy R.
			Leachate	6010	Q7M7203	10/18/95	10/18/95	YES	IM6546	Sloan R.
			Leachate	7470	Q7G7206	10/18/95	10/18/95	YES	I55297	Sloan R.
			Leachate	8080	Q7P51525	10/17/95	10/24/95	YES	^Z1809	Kunselman A.
			Leachate	8150	Q7H51524	10/18/95	10/23/95	YES	^H2919	Stewart L.
			Leachate	8240	Q7V4732	10/21/95	10/21/95	YES	C6260	Knieriem G.
			Leachate	8270	Q7C51523	10/18/95	10/18/95	YES	B8384	Bigelow K.

APPENDIX A  
DATA SUMMARY REPORT

# DATA SUMMARY REPORT

DATE: 10/25/95

PAGE: 1

Company: OHM REMEDIATION SERVICES CORP.

Sample Point ID: P-1A  
ASC Sample Number: JO9400  
Sample Date: 951016  
Facility Code: 018146T

Parameters Units

## RCRA TCLP Leachate Herbicide Analysis, GC, (GS52)

2,4-D	mg/L	<.0005
2,4,5-TP (Silvex)	mg/L	<.0005

## TCLP Pesticide and PCB Analysis, GC, (GS55)

Aldrin	mg/L	<.0001
Alpha-BHC	mg/L	.0008
Beta-BHC	mg/L	<.0001
Chlordane	mg/L	<.001
4,4'-DDD	mg/L	<.0001
4,4'-DDE	mg/L	<.0001
4,4'-DDT	mg/L	<.0001
Delta-BHC	mg/L	<.0001
Dieldrin	mg/L	.0003
Endosulfan sulfate	mg/L	<.0001
Endosulfan I	mg/L	<.0001
Endosulfan II	mg/L	<.0001
Endrin	mg/L	<.0001
Endrin aldehyde	mg/L	<.0001
Gamma-BHC	mg/L	.0001
Heptachlor	mg/L	<.0001
Heptachlor epoxide	mg/L	<.0001
Toxaphene	mg/L	<.002
Methoxychlor	mg/L	<.0001
Aroclor 1016	mg/L	<.001
Aroclor 1221	mg/L	<.001
Aroclor 1232	mg/L	<.001
Aroclor 1242	mg/L	<.001
Aroclor 1248	mg/L	<.001
Aroclor 1254	mg/L	<.001
Aroclor 1260	mg/L	<.001

# DATA SUMMARY REPORT

Company: OHM REMEDIATION SERVICES CORP.

DATE: 10/25/95

PAGE: 2

Sample Point ID: P-1A  
ASC Sample Number: JO9400  
Sample Date: 951016  
Facility Code: 018146T

Parameters

Units

## Special Requested Leachate Metals Analysis, (ME42)

Aluminum	mg/L	<.100
Antimony	mg/L	<.060
Arsenic	mg/L	<.100
Barium	mg/L	.276
Beryllium	mg/L	<.005
Cadmium	mg/L	<.005
Calcium	mg/L	853
Chromium	mg/L	<.020
Cobalt	mg/L	<.020
Copper	mg/L	<.020
Iron	mg/L	<.100
Lead	mg/L	<.100
Magnesium	mg/L	40.5
Manganese	mg/L	.110
Mercury	mg/L	<.001
Molybdenum	mg/L	.248
Nickel	mg/L	.388
Potassium	mg/L	19.0
Selenium	mg/L	<.100
Silver	mg/L	<.020
Sodium	mg/L	4010
Thallium	mg/L	<.100
Vanadium	mg/L	1.14
Zinc	mg/L	.250

## Special Requested TCLP Leachate Semi-Volatile Analysis, MS, (MS47)

1,2,4-Trichlorobenzene	mg/L	<.010
1,2-Dichlorobenzene	mg/L	<.010
1,3-Dichlorobenzene	mg/L	<.010
1,4-Dichlorobenzene	mg/L	<.010
2,4,6-Trichlorophenol	mg/L	<.010
2,4-Dichlorophenol	mg/L	<.010
2,4-Dimethylphenol	mg/L	.037
2,4-Dinitrophenol	mg/L	<.050
2,4-Dinitrotoluene	mg/L	<.010
2,6-Dinitrotoluene	mg/L	<.010

# DATA SUMMARY REPORT

Company: OHM REMEDIATION SERVICES CORP.

DATE: 10/25/95

PAGE: 3

Sample Point ID: P-1A  
 ASC Sample Number: JO9400  
 Sample Date: 951016  
 Facility Code: 018146T

Parameters Units

## Special Requested TCLP Leachate Semi-Volatile Analysis, MS, (MS47)

2-Chloronaphthalene	mg/L	<.010
2-Chlorophenol	mg/L	<.010
2-Nitrophenol	mg/L	<.010
3,3'-Dichlorobenzidine	mg/L	<.010
4,6-Dinitro-o-cresol	mg/L	<.025
4-Bromophenyl phenyl ether	mg/L	<.010
4-Chlorophenyl phenyl ether	mg/L	<.010
4-Nitrophenol	mg/L	<.050
Acenaphthene	mg/L	<.010
Acenaphthylene	mg/L	<.010
Anthracene	mg/L	<.010
Benzidine	mg/L	<.010
Benzo(a)anthracene	mg/L	<.010
Benzo(a)pyrene	mg/L	<.010
Benzo(b)fluoranthene	mg/L	<.010
Benzo(ghi)perylene	mg/L	<.010
Benzo(k)fluoranthene	mg/L	<.010
Butyl benzyl phthalate	mg/L	<.010
Chrysene	mg/L	<.010
Di-n-butyl phthalate	mg/L	<.010
Di-n-octyl phthalate	mg/L	<.010
Dibenzo(a,h)anthracene	mg/L	<.010
Diethyl phthalate	mg/L	<.010
Dimethyl phthalate	mg/L	<.010
Fluoranthene	mg/L	<.010
Fluorene	mg/L	<.010
Hexachlorobenzene	mg/L	<.010
Hexachlorobutadiene	mg/L	<.010
Hexachlorocyclopentadiene	mg/L	<.010
Hexachloroethane	mg/L	<.010
Indeno(1,2,3-cd)pyrene	mg/L	<.010
Isophorone	mg/L	<.010
N-Nitrosodi-n-propylamine	mg/L	<.010
N-Nitrosodimethylamine	mg/L	<.010
N-Nitrosodiphenylamine	mg/L	<.010

# DATA SUMMARY REPORT

DATE: 10/25/95

Company: OHM REMEDIATION SERVICES CORP.

PAGE: 4

Sample Point ID: P-1A  
ASC Sample Number: JO9400  
Sample Date: 951016  
Facility Code: 018146T

Parameters

Units

## Special Requested TCLP Leachate Semi-Volatile Analysis, MS, (MS47)

Naphthalene	mg/L	.025
Nitrobenzene	mg/L	<.010
Pentachlorophenol	mg/L	<.010
Phenanthrene	mg/L	<.010
Phenol	mg/L	.098
Pyrene	mg/L	<.010
bis(2-Chloroethoxy)methane	mg/L	<.010
bis(2-Chloroethyl) ether	mg/L	<.010
bis(2-Chloroisopropyl) ether	mg/L	<.010
bis(2-Ethylhexyl)phthalate	mg/L	<.010
p-Chloro-m-cresol	mg/L	<.010

## Special Requested TCLP Leachate (ZHE) Volatile Analysis, MS, (MV53)

1,1,1-Trichloroethane	mg/L	<.050
1,1,2,2-Tetrachloroethane	mg/L	<.050
1,1,2-Trichloroethane	mg/L	<.050
1,1-Dichloroethane	mg/L	<.050
1,1-Dichloroethylene	mg/L	<.050
1,2-Dichloroethane	mg/L	<.050
1,2-Dichloropropane	mg/L	<.050
1,2-Trans-dichloroethylene	mg/L	<.050
2-Chloroethylvinyl ether	mg/L	<.050
Acrolein	mg/L	<.250
Acrylonitrile	mg/L	<.125
Benzene	mg/L	<.050
Bromoform	mg/L	<.050
Carbon tetrachloride	mg/L	<.050
Chlorobenzene	mg/L	<.050
Chlorodibromomethane	mg/L	<.050
Chloroethane	mg/L	<.050
Chloroform	mg/L	<.050
Dichlorobromomethane	mg/L	<.050
Ethylbenzene	mg/L	<.050
Methyl bromide	mg/L	<.050
Methyl chloride	mg/L	<.050

# DATA SUMMARY REPORT

DATE: 10/25/95

Company: OHM REMEDIATION SERVICES CORP.

PAGE: 5

Sample Point ID: P-1A  
ASC Sample Number: JO9400  
Sample Date: 951016  
Facility Code: 018146T

Parameters

Units

## Special Requested TCLP Leachate(ZHE) Volatile Analysis, MS, (MV53)

Methylene chloride	mg/L	.054
Tetrachloroethylene	mg/L	<.050
Toluene	mg/L	.051
Trichloroethylene	mg/L	<.050
Trichlorofluoromethane	mg/L	<.050
Vinyl chloride	mg/L	<.050
cis-1,3-Dichloropropylene	mg/L	<.050
trans-1,3-Dichloropropylene	mg/L	<.050

APPENDIX B

QUANTITATIVE RESULTS

# TCLP PESTICIDE AND PCB ANALYSIS, GC, (GS55)

Company Name

Facility

Sample Point

ASC Sample No.

OHM REMEDIATION SERVICES CORP.

018146T

P-1A

JO9400

Compounds	Sample Results mg/L	Detection Limits mg/L	Blank Results mg/L	Batch Number
Aldrin	ND	.0001	ND	Q7P51525
Alpha-BHC	.0008	.0001	ND	Q7P51525
Beta-BHC	ND	.0001	ND	Q7P51525
Chlordane	ND	.001	ND	Q7P51525
4,4'-DDD	ND	.0001	ND	Q7P51525
4,4'-DDE	ND	.0001	ND	Q7P51525
4,4'-DDT	ND	.0001	ND	Q7P51525
Delta-BHC	ND	.0001	ND	Q7P51525
Dieldrin	.0003	.0001	ND	Q7P51525
Endosulfan sulfate	ND	.0001	ND	Q7P51525
Endosulfan I	ND	.0001	ND	Q7P51525
Endosulfan II	ND	.0001	ND	Q7P51525
Endrin	ND	.0001	ND	Q7P51525
Endrin aldehyde	ND	.0001	ND	Q7P51525
Gamma-BHC	.0001	.0001	ND	Q7P51525
Heptachlor	ND	.0001	ND	Q7P51525
Heptachlor epoxide	ND	.0001	ND	Q7P51525
Toxaphene	ND	.002	ND	Q7P51525
Methoxychlor	ND	.0001	ND	Q7P51525
Aroclor 1016	ND	.001	ND	Q7P51525
Aroclor 1221	ND	.001	ND	Q7P51525
Aroclor 1232	ND	.001	ND	Q7P51525
Aroclor 1242	ND	.001	ND	Q7P51525
roclor 1248	ND	.001	ND	Q7P51525
roclor 1254	ND	.001	ND	Q7P51525
Aroclor 1260	ND	.001	ND	Q7P51525

## RCRA TCLP LEACHATE HERBICIDE ANALYSIS, GC, (GS52)

Company Name

Facility

Sample Point

ASC Sample No.

OHM REMEDIATION SERVICES CORP.

018146T

P-1A

JO9400

Compounds	Sample Results mg/L	Detection Limits mg/L	Blank Results mg/L	Batch Number
2,4-D	ND	.0005	ND	Q7H51524
2,4,5-TP (Silvex)	ND	.0005	ND	Q7H51524

# SPECIAL REQUESTED LEACHATE METALS ANALYSIS, (ME42)

Company Name

Facility

Sample Point

ASC Sample No.

OHM REMEDIATION SERVICES CORP.

018146T

P-1A

JO9400

Compounds	Sample Results mg/L	Detection Limits mg/L	Blank Results mg/L	Batch Number
Aluminum	ND	.100	ND	Q7M7203
Antimony	ND	.060	ND	Q7M7203
Arsenic	ND	.100	ND	Q7M7203
Barium	.276	.100	ND	Q7M7203
Beryllium	ND	.005	ND	Q7M7203
Cadmium	ND	.005	ND	Q7M7203
Calcium	853	1.00	ND	Q7M7203
Chromium	ND	.020	ND	Q7M7203
Cobalt	ND	.020	ND	Q7M7203
Copper	ND	.020	ND	Q7M7203
Iron	ND	.100	ND	Q7M7203
Lead	ND	.100	ND	Q7M7203
Magnesium	40.5	1.00	ND	Q7M7203
Manganese	.110	.010	ND	Q7M7203
Mercury	ND	.001	ND	Q7G7206
Molybdenum	.248	.020	ND	Q7M7203
Nickel	.388	.040	ND	Q7M7203
Potassium	19.0	2.00	ND	Q7M7203
Selenium	ND	.100	ND	Q7M7203
Silver	ND	.020	ND	Q7M7203
Sodium	4010	1.00	ND	Q7M7203
Thallium	ND	.100	ND	Q7M7203
Vanadium	1.14	.020	ND	Q7M7203
Zinc	.250	.200	ND	Q7M7203

SODIUM RESULT IS QUALITATIVE ONLY.

## SPECIAL REQUESTED TCLP LEACHATE SEMI-VOLATILE ANALYSIS, MS, (MS47)

Company Name

Facility

Sample Point

ASC Sample No.

OHM REMEDIATION SERVICES CORP.

018146T

P-1A

J09400

Compounds	Sample Results mg/L	Detection Limits mg/L	Blank Results mg/L	Batch Number
Nitrobenzene	ND	.010	ND	Q7C51523
p-Chloro-m-cresol	ND	.010	ND	Q7C51523
Pentachlorophenol	ND	.010	ND	Q7C51523
Phenanthrene	ND	.010	ND	Q7C51523
Phenol	.098	.010	ND	Q7C51523
Pyrene	ND	.010	ND	Q7C51523

## SPECIAL REQUESTED TCLP LEACHATE(ZHE) VOLATILE ANALYSIS, MS, (MV53)

Company Name	Facility	Sample Point	ASC Sample No.
OHM REMEDIATION SERVICES CORP.	018146T	P-1A	JO9400

Compounds	Sample Results mg/L	Detection Limits mg/L	Blank Results mg/L	Batch Number
1,1,1-Trichloroethane	ND	.050	ND	Q7V4732
1,1,2,2-Tetrachloroethane	ND	.050	ND	Q7V4732
1,1,2-Trichloroethane	ND	.050	ND	Q7V4732
1,1-Dichloroethane	ND	.050	ND	Q7V4732
1,1-Dichloroethylene	ND	.050	ND	Q7V4732
1,2-Dichloroethane	ND	.050	ND	Q7V4732
1,2-Dichloropropane	ND	.050	ND	Q7V4732
1,2-Trans-dichloroethylene	ND	.050	ND	Q7V4732
2-Chloroethylvinyl ether	ND	.050	ND	Q7V4732
Acrolein	ND	.250	ND	Q7V4732
Acrylonitrile	ND	.125	ND	Q7V4732
Benzene	ND	.050	ND	Q7V4732
Bromoform	ND	.050	ND	Q7V4732
Carbon tetrachloride	ND	.050	ND	Q7V4732
Chlorobenzene	ND	.050	ND	Q7V4732
Chlorodibromomethane	ND	.050	ND	Q7V4732
Chloroethane	ND	.050	ND	Q7V4732
Chloroform	ND	.050	ND	Q7V4732
cis-1,3-Dichloropropylene	ND	.050	ND	Q7V4732
Dichlorobromomethane	ND	.050	ND	Q7V4732
Ethylbenzene	ND	.050	ND	Q7V4732
Methyl bromide	ND	.050	ND	Q7V4732
Methyl chloride	ND	.050	ND	Q7V4732
ethylene chloride	.054	.050	ND	Q7V4732
trichloroethylene	ND	.050	ND	Q7V4732
Toluene	.051	.050	ND	Q7V4732
trans-1,3-Dichloropropylene	ND	.050	ND	Q7V4732
Trichloroethylene	ND	.050	ND	Q7V4732
Trichlorofluoromethane	ND	.050	ND	Q7V4732
Vinyl chloride	ND	.050	ND	Q7V4732

Joblink: 619035

## QUALITY ASSURANCE REPORT

[illegible]

[illegible]

[illegible]

[illegible]

# QUALITY ASSURANCE DATA SURROGATE SUMMARY REPORT

SURROGATE ID	A159	B732	A121	A884	A158	B142	# OUT
QC BATCH: Q7C51523 Leachate (Semi-Volatile organics by MS)							
SAMPLE ID							
BLANK	51	34	69	60	65	89	0
BLANK SPIKE	61	42	95	82	87	86	0
P-1A	58	43	99	52	65	75	0
QC LIMITS	(21-110)	(10-110)	(10-123)	(35-114)	(43-116)	(33-141)	

SURROGATE ID	F047	# OUT
QC BATCH: Q7H51524 Leachate (Herbicide compounds by GC)		
SAMPLE ID		
BLANK	121	0
BLANK SPIKE	124	0
P-1A	107	0
QC LIMITS	(30-130)	

SURROGATE ID	B816	A500	# OUT
QC BATCH: Q7P51525 Leachate (Pesticide compounds by GC)			
SAMPLE ID			
BLANK	99	92	0
BLANK SPIKE	113	105	0
P-1A	67	74	0
QC LIMITS	(30-130)	(30-130)	

SURROGATE ID	A047	B185	B668	# OUT
QC BATCH: Q7V4732 Leachate (Volatile organics by MS)				
SAMPLE ID				
BLANK	93	104	90	0
BLANK SPIKE	83	104	94	0
P-1A	97	109	97	0
P-1B MD	102	105	99	0
P-1B MS	101	108	97	0
QC LIMITS	(70-121)	(81-117)	(74-121)	

SURROGATE ID	
A047 = 1,2-Dichloroethane-D4	A500 = Decachlorobiphenyl
B185 = Toluene-D8	F047 = 2,4-Dichlorophenylacetic-acid
B668 = Bromofluorobenzene	
A159 = 2-Fluorophenol	
B732 = Phenol-D6	
A121 = 2,4,6-Tribromophenol	
A884 = Nitrobenzene-D5	
A158 = 2-Fluorobiphenyl	
B142 = Terphenyl-D14	
B16 = 2,4,5,6-Tetrachloro-m-xylene	

\* Values outside of method quality control limits  
D Sample was diluted, however, some surrogates may be reported if results were observed.

It is laboratory policy to allow one surrogate per sample fraction (acid, base-neutral or pesticide) to exceed the stated QC limits. This policy is based upon the USEPA SOW for the Contract Laboratory Program (CLP).

## METHODOLOGY REFERENCES

---

- ASTM      *American Society for Testing and Materials*, 1985 edition.
- MCAWW    *Methods for Chemical Analysis of Water and Wastes*, April 1979 and Updated #1 March 1983.
- CLP        *USEPA Contract Laboratory Program*, Document #OLMO3.0, update August 1994 #OLMO3.1 and Document #ILMO4.0.
- EPA-500   *USEPA Methods for the Determination of Organic Compounds in Drinking Water*, EPA-600/4-88/039 December 1988.
- EPA-600   *USEPA Test Methods for Organic Chemical Analysis of Municipal and Industrial Wastewater*, EPA-600/4-82-057 July 1982.
- NIOSH     *National Institute for Occupational Safety and Health*, 3rd edition, 1984.
- SMEWW    *Standard Methods for the Examination of Water and Wastewater*, 17th edition, 1989.
- STOA      *Spot Tests In Organic Analysis*, 7th edition, 1966.
- SW-846    *Test Methods for Evaluating Solid Wastes, Physical/Chemical Methods*, 3rd edition, September 1986 and Update #1 July 1992.
- (1)        This method was modified to incorporate the use of Boron Trifluoride (BF<sub>3</sub>) as the derivatizing reagent according to Method 6640 in SMEWW, 17th edition, 1989.
- Title 22    *Waste Extraction Test*, Title 22, Section 66261.126 Appendix 2 of the California Administrative Code, May 1991.

## Laboratory Certifications

State	Agency	Certification #
Alabama	ADEM	40830
California	CADOH	1178
Colorado	CODOH	OH113
Connecticut	CDPH & AS	PH-0154
Delaware	DEHSS	OH113
Kansas	KSDHE	E-202 & E-1173
Louisiana	LADOHH	92-10
Maryland	MDDHMH	210
Massachusetts	MADEP	M-OH113
New Jersey	NJDEPE	74603
New York	NYDOH	10712
North Carolina	NCDEM	392
Ohio	OHEPA	OH113
Oklahoma	OKDEQ	9216
Pennsylvania	PADER	68-450
Rhode Island	RIDOH	214/142
South Carolina	SCDEHNR	92002
Tennessee	TNDOH/TNDEC	2978
Virginia	VADGS	00011
Washington	WADOE	C154
Wisconsin	WIDNR	999037160

Validated by:

o US Army Corps of Engineers ..... Chemical Analysis in Various Matrices

Approvals:

o EnviroSAFE	Waste Characterization Analysis
o USDA	Permit for Importing Soils
o Florida DEP	Quality Assurance Plan #930034G
o Naval Facilities Engineering Service Center	Chemical Analysis in Various Matrices

## REPORT KEY

---

mg/kg	= milligram per kilogram (ppm)
Mg/m <sup>3</sup>	= milligram per cubic meter
ug/kg	= microgram per kilogram (ppb)
mg/L	= milligram per liter (ppm)
ug/L	= microgram per liter (ppb)
mg/W	= milligram per wipe
ug/W	= microgram per wipe
mg/SMP	= milligram per sample
ug/SMP	= microgram per sample (Tedlar Bag)
ug/smp	= microgram per sample
um/cm	= microMho per centimeter
pCi/l	= picocurie per liter
gm/cc	= grams per cubic centimeter
ppm	= parts per million
ppb	= parts per billion
ND	= Not detected at or above stated detection limit
<	= less than
>	= greater than
%	= percent
BTU/lb	= British Thermal Units per pound
Deg. C	= Degrees Celsius
n/a	= not applicable
Unk	= unknown
std	= result is relative to standard pH units
CV	= Conventional
IR	= Infrared Spectrophotometric
GC	= Gas Chromatograph Instrument
GC/MS	= Gas Chromatography/Mass Spectrometer Instrument
GRO	= Gasoline Range Organics
DRO	= Diesel Range Organics
PCB	= Polychlorinated Biphenyls (PCBs)
EP TOX	= Extraction Procedure Toxicity
TCLP	= Toxicity Characteristic Leaching Procedure
RCRA	= Resource Conservation and Recovery Act
SOW	= Statement of Work

APPENDIX D

CHAIN-OF-CUSTODY RECORD(S)  
AND  
ANALYTICAL REQUEST FORM(S)

# CHAIN-OF-CUSTODY RECORD

LAB COPY

Form 0019  
Field Technical Services  
Rev. 08/89

169414

O.H. MATERIALS CORP. • P.O. BOX 551 • FINDLAY, OH 45839-0551 • 419-423-3526

PROJECT NAME <i>Protec</i>		PROJECT LOCATION		ANALYSIS DESIRED (INDICATE SEPARATE CONTAINERS) <i>YES AAF</i>													
PROJ. NO. <i>18146</i>	PROJECT CONTACT <i>Pat Brine</i>	PROJECT TELEPHONE NO. <i>X-4105</i>															
CLIENT'S REPRESENTATIVE		PROJECT MANAGER/SUPERVISOR															
ITEM NO	SAMPLE NUMBER	DATE	TIME	COMP	GRAB	SAMPLE DESCRIPTION (INCLUDE MATRIX AND POINT OF SAMPLE)	NUMBER OF CONTAINERS	REMARKS									
1	<i>P-1A</i>	<i>10-16 1995</i>	<i>10:30</i>			<i>.05 Portland Cement</i>	<i>1-16oz contain.</i>	<i>Plastic Specimen Cups</i>									
2																	
3																	
4																	
5																	
6																	
7																	
8																	
9																	
10																	

TRANSFER NUMBER	ITEM NUMBER	TRANSFERS RELINQUISHED BY	TRANSFERS ACCEPTED BY	DATE	TIME	REMARKS
1	1	<i>Pat Brine</i>	<i>Donita Jensen</i>	<i>10-16 95</i>	<i>10:42</i>	<i>Pat Brine</i> SAMPLER'S SIGNATURE
2						
3						
4						



TREATABILITY ANALYTICAL REQUEST FORM

Job # 18146

Name PROTECO

COC 169414

Number of Samples

Soils \_\_\_\_\_ Sludges \_\_\_\_\_ Liquids \_\_\_\_\_ Air (Tedlar Bags) \_\_\_\_\_

Filter Cakes \_\_\_\_\_ Stabilized Material 1 Slurry Solids \_\_\_\_\_ Slurries \_\_\_\_\_

Solvents \_\_\_\_\_ Other (specify) \_\_\_\_\_

Turn Around Times

The turn around time requested 7 days Preliminary results due \_\_\_\_\_ Final results due \_\_\_\_\_

QA/QC (Check the appropriate box below.)

- ☒ Standard Standard level of QA/QC supplied by the lab, this corresponds roughly to QA2 without the blanks.
- ☐ QA1 Sample documentation. Instrument calibration or performance check, detection limits where applicable.
- ☐ QA2 QA1 + COC, holding times, method blank, rinsate blank, & trip blank (extra cost).
- ☐ QA3 QA2 + performance check samples (one per matrix), & matrix spikes. (Significant extra cost.)
- ☐ CLP Full CLP protocol. (Significant extra cost.)

Physical Testing

- ☐ BTU (ASTM D240-76) ☐ pH (EPA 150.1 or 9045) ☐ Flashpoint (1010)  
☐ Specific Gravity ☐ Physical Description ☐ Other \_\_\_\_\_

Inorganic Analyses

- |  |  |   |  |                                      |                                    |
|--|--|---|--|--------------------------------------|------------------------------------|
| <input type="checkbox"/> Total Cyanide               | <input type="checkbox"/> Amenable Cyanide                            | <input type="checkbox"/> Reactive Cyanide | <input type="checkbox"/> Total Sulfide             |                                      |                                    |
| <input type="checkbox"/> Reactive Sulfide            | <input type="checkbox"/> Total Chloride                              | <input type="checkbox"/> Total Sulfate    | <input type="checkbox"/> Total Nitrate             |                                      |                                    |
| <input type="checkbox"/> Total Phosphate             | <input type="checkbox"/> Total RCRA metals (all by 6010, Hg by 7470) |   | <input type="checkbox"/> Priority Pollutant Metals |                                      |                                    |
| <input type="checkbox"/> Specific metals (see below) |  |   |  |                                      |                                    |
| <input type="checkbox"/> Aluminum                    | <input type="checkbox"/> Arsenic                                     | <input type="checkbox"/> Barium           | <input type="checkbox"/> Beryllium                 | <input type="checkbox"/> Cadmium     | <input type="checkbox"/> Calcium   |
| <input type="checkbox"/> Chromium                    | <input type="checkbox"/> Cobalt                                      | <input type="checkbox"/> Copper           | <input type="checkbox"/> Iron                      | <input type="checkbox"/> Lead        | <input type="checkbox"/> Magnesium |
| <input type="checkbox"/> Manganese                   | <input type="checkbox"/> Mercury                                     | <input type="checkbox"/> Molybdenum       | <input type="checkbox"/> Nickel                    | <input type="checkbox"/> Potassium   | <input type="checkbox"/> Thallium  |
| <input type="checkbox"/> Selenium                    | <input type="checkbox"/> Silver                                      | <input type="checkbox"/> Vanadium         | <input type="checkbox"/> Zinc                      | <input type="checkbox"/> Other _____ |                                    |



Organic Analysis

- |   |   |  |   |
|---|---|--|---|
| <input type="checkbox"/> TPH IR (418.1)           | <input type="checkbox"/> TPH Grav (418.2)                           | <input type="checkbox"/> TPH GC (8015M)    | <input type="checkbox"/> GRO (8015M)          |
| <input type="checkbox"/> DRO (8015M)              | <input type="checkbox"/> CA LUFT                                    | <input type="checkbox"/> BTEX (8240)       | <input type="checkbox"/> Oil & Grease (413.1) |
| <input type="checkbox"/> Volatile Organics (8240) | <input type="checkbox"/> Semivolatile Organics (8270)               | <input type="checkbox"/> Pesticides (8080) |   |
| <input type="checkbox"/> Herbicides               | <input type="checkbox"/> PAHs (HPLC)                                | <input type="checkbox"/> PCBs (8080)       | <input type="checkbox"/> Dioxins/Furans       |
| <input type="checkbox"/> TOC                      | <input type="checkbox"/> TICs greater than 25% of internal standard |  |   |
- ☐ Other \_\_\_\_\_
- ☐ Silica gel clean-up required on extract prior to analysis

TCLP Extraction

- |   |   |  |
|---|---|--|
| <input checked="" type="checkbox"/> Volatile Organics (TCLP List) | <input type="checkbox"/> Semivolatiles (TCLP List)          | <input type="checkbox"/> Metals (TCLP List)          |
| <input type="checkbox"/> Herbicides (TCLP List)                   | <input type="checkbox"/> Pesticides (TCLP List)             | <input checked="" type="checkbox"/> PCBs (8080)      |
| <input checked="" type="checkbox"/> Volatile Organics (PP List)   | <input checked="" type="checkbox"/> Semivolatiles (PP List) | <input checked="" type="checkbox"/> Metals (PP List) |
| <input checked="" type="checkbox"/> Herbicides (PP List)          | <input checked="" type="checkbox"/> Pesticides (PP List)    | <input type="checkbox"/> Specific metals (see below) |
- |                                    |                                  |                                     |                                    |                                      |                                    |
|------------------------------------|----------------------------------|-------------------------------------|------------------------------------|--------------------------------------|------------------------------------|
| <input type="checkbox"/> Aluminum  | <input type="checkbox"/> Arsenic | <input type="checkbox"/> Barium     | <input type="checkbox"/> Beryllium | <input type="checkbox"/> Cadmium     | <input type="checkbox"/> Calcium   |
| <input type="checkbox"/> Chromium  | <input type="checkbox"/> Cobalt  | <input type="checkbox"/> Copper     | <input type="checkbox"/> Iron      | <input type="checkbox"/> Lead        | <input type="checkbox"/> Magnesium |
| <input type="checkbox"/> Manganese | <input type="checkbox"/> Mercury | <input type="checkbox"/> Molybdenum | <input type="checkbox"/> Nickel    | <input type="checkbox"/> Potassium   | <input type="checkbox"/> Thallium  |
| <input type="checkbox"/> Selenium  | <input type="checkbox"/> Silver  | <input type="checkbox"/> Vanadium   | <input type="checkbox"/> Zinc      | <input type="checkbox"/> Other _____ |                                    |
- ☐ Other \_\_\_\_\_

Other Considerations

- |   |   |
|---|---|
| <input type="checkbox"/> Report results on a dry weight basis                               | <input type="checkbox"/> Include chromatograms with results |
| <input type="checkbox"/> Specific detection limits required (check appropriate level below) |   |
| <input type="checkbox"/> >10 ppm  | <input type="checkbox"/> 10 ppm - 1 ppm                     |
| <input type="checkbox"/> 1 ppm - 100 ppb  | <input checked="" type="checkbox"/> 100 ppb - 1 ppb         |
| <input type="checkbox"/> Anticipated contaminant levels (check appropriate level below)     | <input type="checkbox"/> <1ppb                              |
| <input type="checkbox"/> 10,000 ppm   | <input type="checkbox"/> 1,000 ppm                          |
| <input checked="" type="checkbox"/> 100 ppm   | <input type="checkbox"/> 10 ppm                             |
| <input type="checkbox"/> 1 ppm  | <input type="checkbox"/> <1 ppm                             |
- NEED AS LOW AS PRACTICAL

Approvals

Approved by:

Date:

10/11/95



OHM Remediation  
Services Corp.  
A Subsidiary of OHM Corporation

## ANALYTICAL DIVISION

Laboratory Analysis

Report(s) #619050

**Client:** OHM Remediation Services Corp.  
TAC Treatability, Findlay, OH

**Attn:** Paul Lear

**Project:** 18146T - Proteco

**Sample(s) Received:** October 18, 1995


**Data Due:** October 31, 1995

**Order Received:** October 18, 1995

**Data Reported:** October 31, 1995

*This report is "PROPRIETARY AND CONFIDENTIAL" and delivered to, and intended for the exclusive use of the above named client only. OHM Remediation Services Corp., Analytical Division, assumes no responsibility or liability for the reliance hereon or use hereof by anyone other than the above named client.*

*Reviewed and Approved by:*

  
Thomas E. Gran, Ph.D., Vice President

*Date:* November 2, 1995

## PROJECT NARRATIVE

---

The following items relate to the samples and analytical data contained in this report.

- o All solid sample results are reported on an as received basis, except for PCBs which are reported on a "dry weight" basis.
- o Note any comments at the bottom of the tables in Appendices B and C.
- o Matrix spike recoveries were outside QC limits for Batches #Q2C51597A, #Q2P51599 and #Q2M7253 due to sample matrix interferences. Batch acceptance is based on method spike recoveries which are within QC limits.
- o Due to high levels of target analytes present in the unspiked sample, matrix spike recoveries are outside QC limits for Batch #Q2M7253. Batch acceptance is based on method spike recoveries which are within QC limits.
- o Insufficient sample volume was available to perform matrix spikes for Batches #Q7C51536, #Q7H51539 and #Q7P51537. Batch acceptance is based on method spike recoveries.
- o Surrogate recoveries are outside QC limits for Batches #Q2C51597A, #Q2P51599 and #Q7P51537 due to sample matrix interferences. This matrix effect was confirmed by replicate analysis.

---

The following relate to the timeliness and completeness of the analytical data reported:

- o Data was reported to Mr. Paul Lear on Tuesday, October 31, 1995. The results were not reported within the required time frame due to a laboratory error.

# SAMPLE INFORMATION SUMMARY

Sample Id	Lab Id	Sample Date	Matrix	Method	QC Batch #	Prep Date	Analysis Date	Hold Met	Run #	Analyst
P-1B	JO9480	10/18/95	Leachate	1311 1311-ZHE	Q7G7209	10/19/95	10/19/95	YES	I55327	Sloan R.
			Leachate		Q7C51536	10/19/95	10/19/95	YES	E7850	Bigelow K.
			Leachate		Q7V4732	10/21/95	10/21/95	YES	C6261	Knieriem G.
			Leachate		Q7M7213	10/19/95	10/23/95	YES	IM6817	Sloan R.
			Leachate		Q7H51539	10/19/95	10/24/95	YES	^H2935	Stewart L.
			Leachate		Q7P51537	10/19/95	10/26/95	YES	^E1094	Stewart L.
			Solid			10/18/95	N/A	YES		Biery M.
			Solid			10/18/95	N/A	YES		Biery M.
P-1B	JO9821	10/18/95	Solid	6010 7471 8080 8150 8240 8270	Q2M7253	10/28/95	10/29/95	YES	IM7302	Sloan R.
			Solid		Q2G7252	10/28/95	10/28/95	YES	I55540	Henschen S.
			Solid		Q2P51599	10/27/95	10/31/95	YES	^E1186	Kunselman A.
			Solid		Q2H51522	10/30/95	10/30/95	YES	^H2986	Stewart L.
			Solid		Q2V4746	10/30/95	10/30/95	YES	C6422	Knieriem G.
			Solid		Q2C51597A	10/27/95	10/31/95	YES	B8603	Bigelow K.

APPENDIX A  
DATA SUMMARY REPORT

# DATA SUMMARY REPORT

DATE: 11/01/95

Company: OHM REMEDIATION SERVICES CORP.

PAGE: 1

Sample Point ID: P-1B  
ASC Sample Number: JO9821  
Sample Date: 951018  
Facility Code: 018146T

Parameters Units

## Volatile Tentatively Identified Compounds , GC/MS, (CL1E)

4,7-Methano-1H-indene, 3a,4,7,	mg/kg	30.9 J
Decane	mg/kg	15.0 J
Decanedioic acid, ester isomer	mg/kg	41.6 J
Decanedioic acid, ester isomer	mg/kg	14.3 J
Decanedioic acid, ester isomer	mg/kg	18.7 J
Naphthalene, 2-methyl-	mg/kg	14.0 J
unknown	mg/kg	37.1 J
unknown	mg/kg	33.4 J

Sample Point ID: P-1B  
ASC Sample Number: JO9821  
Sample Date: 951018  
Facility Code: 018146T

Parameters Units

## Semivolatile Tentatively Identified Compounds, GC/MS, (CL1F)

4,7-Methano-1H-indene, 3a,4,7,	mg/kg	16.9 J
Cyclohexane, 2-butyl-1,1,3-tri	mg/kg	15.5 J
Docosane	mg/kg	20.3 J
Dodecane	mg/kg	24.3 J
Dodecane, 2,6,10-trimethyl-	mg/kg	24.4 J
Dodecane, 2,7,10-trimethyl-	mg/kg	45.4 J
Dodecane, 2-methyl-6-propyl-	mg/kg	13.8 J
Eicosane	mg/kg	27.3 J
Heptadecane	mg/kg	33.9 J
Heptadecane, 2,6-dimethyl-	mg/kg	60.0 J
Hexadecane	mg/kg	34.0 J
Hexadecane	mg/kg	53.7 J
Hexadecane	mg/kg	21.4 J
Naphthalene, 1,4,6-trimethyl-	mg/kg	18.0 J
Naphthalene, 1-ethyl-	mg/kg	23.0 J
Naphthalene, 2,3-dimethyl-	mg/kg	23.1 J
Nonadecane	mg/kg	28.9 J

# DATA SUMMARY REPORT

DATE: 11/01/95

Company: OHM REMEDIATION SERVICES CORP.

PAGE: 2

Sample Point ID: P-1B  
 ASC Sample Number: JO9821  
 Sample Date: 951018  
 Facility Code: 018146T

Parameters Units

## Semivolatile Tentatively Identified Compounds, GC/MS, (CL1F)

Pentadecane	mg/kg	44.3 J
Pentadecane, 8-hexyl-	mg/kg	14.4 J
Tetradecane	mg/kg	11.9 J
Tetradecane	mg/kg	35.3 J
Tridecane	mg/kg	33.6 J
Tridecane	mg/kg	30.4 J
Tridecane, 7-methyl-	mg/kg	19.1 J
Undecane	mg/kg	20.8 J
Undecane, 2,6-dimethyl-	mg/kg	13.6 J
Unk hydrocarbon	mg/kg	17.5 J
Unk hydrocarbon	mg/kg	12.7 J
Unk hydrocarbon	mg/kg	16.2 J
unknown	mg/kg	15.0 J

Sample Point ID: P-1B  
 ASC Sample Number: JO9821  
 Sample Date: 951018  
 Facility Code: 018146T

Parameters Units

## Total Herbicide Analysis, GC, (GS02)

2,4-D	mg/kg	<.093
2,4,5-T	mg/kg	<.093
2,4,5-TP (Silvex)	mg/kg	<.093

# DATA SUMMARY REPORT

DATE: 11/01/95

Company: OHM REMEDIATION SERVICES CORP.

PAGE: 3

Sample Point ID: P-1B  
 ASC Sample Number: JO9821  
 Sample Date: 951018  
 Facility Code: 018146T

Parameters Units

## Total Pesticide and PCB Analysis, GC, (GS05)

Aldrin	mg/kg	<.033
Alpha-BHC	mg/kg	<.033
Beta-BHC	mg/kg	<.033
Chlordane	mg/kg	<.331
1,4'-DDD	mg/kg	<.033
1,4'-DDE	mg/kg	<.033
1,4'-DDT	mg/kg	<.033
Delta-BHC	mg/kg	<.033
Dieldrin	mg/kg	<.033
Endosulfan sulfate	mg/kg	<.033
Endosulfan I	mg/kg	<.033
Endosulfan II	mg/kg	<.033
Endrin	mg/kg	<.033
Endrin aldehyde	mg/kg	<.033
Endrin ketone	mg/kg	<.033
Gamma-BHC	mg/kg	<.033
Heptachlor	mg/kg	<.033
Heptachlor epoxide	mg/kg	<.033
Methoxychlor	mg/kg	<.033
Toxaphene	mg/kg	<.662
Aroclor 1016	mg/kg	<.331
Aroclor 1221	mg/kg	<.331
Aroclor 1232	mg/kg	<.331
Aroclor 1242	mg/kg	<.331
Aroclor 1248	mg/kg	<.331
Aroclor 1254	mg/kg	<.331
Aroclor 1260	mg/kg	<.331

# DATA SUMMARY REPORT

DATE: 11/01/95

PAGE: 4

Company: OHM REMEDIATION SERVICES CORP.

Sample Point ID: P-1B  
 ASC Sample Number: JO9480  
 Sample Date: 951018  
 Facility Code: 018146T

Parameters Units

## RCRA TCLP Leachate Herbicide Analysis, GC, (GS52)

2,4-D	mg/L	<.0005
2,4,5-TP (Silvex)	mg/L	<.0005

Sample Point ID: P-1B  
 ASC Sample Number: JO9480  
 Sample Date: 951018  
 Facility Code: 018146T

Parameters Units

## TCLP Pesticide and PCB Analysis, GC, (GS55)

Aldrin	mg/L	<.0001
Alpha-BHC	mg/L	<.0001
Beta-BHC	mg/L	<.0001
Chlordane	mg/L	<.001
1,1'-DDD	mg/L	<.0001
1,1'-DDE	mg/L	<.0001
1,1'-DDT	mg/L	<.0001
Delta-BHC	mg/L	<.0001
Dieldrin	mg/L	<.0001
Endosulfan sulfate	mg/L	<.0001
Endosulfan I	mg/L	<.0001
Endosulfan II	mg/L	<.0001
Endrin	mg/L	<.0001
Endrin aldehyde	mg/L	<.0001
Gamma-BHC	mg/L	<.0001
Heptachlor	mg/L	<.0001
Heptachlor epoxide	mg/L	<.0001
Toxaphene	mg/L	<.002
Methoxychlor	mg/L	<.0001
Aroclor 1016	mg/L	<.001
Aroclor 1221	mg/L	<.001
Aroclor 1232	mg/L	<.001
Aroclor 1242	mg/L	<.001

# DATA SUMMARY REPORT

DATE: 11/01/95

Company: OHM REMEDIATION SERVICES CORP.

PAGE: 5

Sample Point ID: P-1B  
 ASC Sample Number: JO9480  
 Sample Date: 951018  
 Facility Code: 018146T

Parameters Units

## PCLP Pesticide and PCB Analysis, GC, (GS55)

Aroclor 1248	mg/L	<.001
Aroclor 1254	mg/L	<.001
Aroclor 1260	mg/L	<.001

Sample Point ID: P-1B  
 ASC Sample Number: JO9821  
 Sample Date: 951018  
 Facility Code: 018146T

Parameters Units

## Target Analyte List Total Metals Analysis, (ME20)

Aluminum	mg/kg	9950
Antimony	mg/kg	<3.94
Arsenic	mg/kg	<9.85
Barium	mg/kg	176
Beryllium	mg/kg	<1.97
Cadmium	mg/kg	<1.97
Calcium	mg/kg	281000
Chromium	mg/kg	125
Cobalt	mg/kg	22.0
Copper	mg/kg	161
Iron	mg/kg	39800
Lead	mg/kg	143
Magnesium	mg/kg	8920
Manganese	mg/kg	374
Mercury	mg/kg	.370
Nickel	mg/kg	453
Potassium	mg/kg	2290
Selenium	mg/kg	<9.85
Silver	mg/kg	<1.97
Sodium	mg/kg	1540
Thallium	mg/kg	<9.85
Vanadium	mg/kg	1620

# DATA SUMMARY REPORT

DATE: 11/01/95

Company: OHM REMEDIATION SERVICES CORP.

PAGE: 6

Sample Point ID: P-1B  
ASC Sample Number: JO9821  
Sample Date: 951018  
Facility Code: 018146T

Parameters Units

## Target Analyte List Total Metals Analysis, (ME20)

Zinc mg/kg 303

Sample Point ID: P-1B  
ASC Sample Number: JO9480  
Sample Date: 951018  
Facility Code: 018146T

Parameters Units

## Special Requested Leachate Metals Analysis, (ME42)

Aluminum	mg/L	<.100
Antimony	mg/L	<.060
Arsenic	mg/L	<.100
Barium	mg/L	.197
Beryllium	mg/L	<.005
Cadmium	mg/L	<.005
Calcium	mg/L	696
Chromium	mg/L	<.020
Cobalt	mg/L	<.020
Copper	mg/L	.044
Iron	mg/L	<.100
Lead	mg/L	<.100
Magnesium	mg/L	10.5
Manganese	mg/L	<.010
Mercury	mg/L	<.001
Molybdenum	mg/L	.286
Nickel	mg/L	.212
Potassium	mg/L	20.2
Selenium	mg/L	<.100
Silver	mg/L	<.020
Sodium	mg/L	4320
Thallium	mg/L	<.100
Vanadium	mg/L	4.69
Zinc	mg/L	<.200

# DATA SUMMARY REPORT

DATE: 11/01/95

Company: OHM REMEDIATION SERVICES CORP.

PAGE: 7

Sample Point ID: P-1B  
 ASC Sample Number: JO9821  
 Sample Date: 951018  
 Facility Code: 018146T

Parameters Units

## Total Base/Neutral/Acid Analysis, MS, (MS02)

Acenaphthene	mg/kg	<4.00
Acenaphthylene	mg/kg	<4.00
Anthracene	mg/kg	<4.00
Benzidine	mg/kg	<4.00
Benzo(a)anthracene	mg/kg	<4.00
Benzo(b)fluoranthene	mg/kg	<4.00
Benzo(k)fluoranthene	mg/kg	<4.00
Benzo(ghi)perylene	mg/kg	<4.00
Benzo(a)pyrene	mg/kg	<4.00
bis(2-Chloroethyl) ether	mg/kg	<4.00
bis(2-Chloroethoxy)methane	mg/kg	<4.00
bis(2-Chloroisopropyl) ether	mg/kg	<4.00
bis(2-Ethylhexyl)phthalate	mg/kg	12.4
4-Bromophenyl phenyl ether	mg/kg	<4.00
Butyl benzyl phthalate	mg/kg	<4.00
Carbazole	mg/kg	<4.00
4-Chloroaniline	mg/kg	<4.00
p-Chloro-m-cresol	mg/kg	<4.00
2-Chloronaphthalene	mg/kg	<4.00
2-Chlorophenol	mg/kg	<4.00
4-Chlorophenyl phenyl ether	mg/kg	<4.00
Chrysene	mg/kg	4.84
Dibenzo(a,h)anthracene	mg/kg	<4.00
Dibenzofuran	mg/kg	<4.00
Di-n-butyl phthalate	mg/kg	<4.00
1,2-Dichlorobenzene	mg/kg	<4.00
1,3-Dichlorobenzene	mg/kg	<4.00
1,4-Dichlorobenzene	mg/kg	<4.00
3,3'-Dichlorobenzidine	mg/kg	<4.00
2,4-Dichlorophenol	mg/kg	<4.00
Diethyl phthalate	mg/kg	<4.00
Dimethyl phthalate	mg/kg	<4.00
2,4-Dimethylphenol	mg/kg	<4.00
4,6-Dinitro-o-cresol	mg/kg	<10.0
2,4-Dinitrophenol	mg/kg	<20.0

# DATA SUMMARY REPORT

DATE: 11/01/95

PAGE: 8

Company: OHM REMEDIATION SERVICES CORP.

Sample Point ID: P-1B  
 ASC Sample Number: JO9821  
 Sample Date: 951018  
 Facility Code: 018146T

Parameters Units

## Total Base/Neutral/Acid Analysis, MS, (MS02)

2,4-Dinitrotoluene	mg/kg	<4.00
2,6-Dinitrotoluene	mg/kg	<4.00
Di-n-octyl phthalate	mg/kg	<4.00
Fluoranthene	mg/kg	<4.00
Fluorene	mg/kg	<4.00
Hexachlorobenzene	mg/kg	<4.00
Hexachlorobutadiene	mg/kg	<4.00
Hexachlorocyclopentadiene	mg/kg	<4.00
Hexachloroethane	mg/kg	<4.00
Indeno (1,2,3-cd) pyrene	mg/kg	<4.00
Isophorone	mg/kg	<4.00
2-Methylnaphthalene	mg/kg	22.7
2-Methylphenol	mg/kg	<4.00
4-Methylphenol	mg/kg	<4.00
N-Nitrosodimethylamine	mg/kg	<4.00
N-Nitrosodi-n-propylamine	mg/kg	<4.00
N-Nitrosodiphenylamine	mg/kg	<4.00
Naphthalene	mg/kg	8.56
2-Nitroaniline	mg/kg	<4.00
3-Nitroaniline	mg/kg	<4.00
4-Nitroaniline	mg/kg	<4.00
Nitrobenzene	mg/kg	<4.00
2-Nitrophenol	mg/kg	<4.00
4-Nitrophenol	mg/kg	<20.0
Pentachlorophenol	mg/kg	<4.00
Phenanthrene	mg/kg	19.6
Phenol	mg/kg	4.04
Pyrene	mg/kg	6.44
Pyridine	mg/kg	<4.00
1,2,4-Trichlorobenzene	mg/kg	<4.00
2,4,5-Trichlorophenol	mg/kg	<4.00
2,4,6-Trichlorophenol	mg/kg	<4.00

# DATA SUMMARY REPORT

DATE: 11/01/95

Company: OHM REMEDIATION SERVICES CORP.

PAGE: 9

Sample Point ID: P-1B  
 ASC Sample Number: JO9480  
 Sample Date: 951018  
 Facility Code: 018146T

Parameters Units

## Special Requested TCLP Leachate Semi-Volatile Analysis, MS, (MS47)

1,2,4-Trichlorobenzene	mg/L	<.010
1,2-Dichlorobenzene	mg/L	<.010
1,3-Dichlorobenzene	mg/L	<.010
1,4-Dichlorobenzene	mg/L	<.010
2,4,6-Trichlorophenol	mg/L	<.010
2,4-Dichlorophenol	mg/L	<.010
2,4-Dimethylphenol	mg/L	.028
2,4-Dinitrophenol	mg/L	<.050
2,4-Dinitrotoluene	mg/L	<.010
2,6-Dinitrotoluene	mg/L	<.010
2-Chloronaphthalene	mg/L	<.010
2-Chlorophenol	mg/L	<.010
2-Nitrophenol	mg/L	<.010
3,3'-Dichlorobenzidine	mg/L	<.010
4,6-Dinitro-o-cresol	mg/L	<.025
4-Bromophenyl phenyl ether	mg/L	<.010
4-Chlorophenyl phenyl ether	mg/L	<.010
4-Nitrophenol	mg/L	<.050
Acenaphthene	mg/L	<.010
Acenaphthylene	mg/L	<.010
Anthracene	mg/L	<.010
Benzidine	mg/L	<.010
Benzo(a)anthracene	mg/L	<.010
Benzo(a)pyrene	mg/L	<.010
Benzo(b)fluoranthene	mg/L	<.010
Benzo(ghi)perylene	mg/L	<.010
Benzo(k)fluoranthene	mg/L	<.010
Butyl benzyl phthalate	mg/L	<.010
Chrysene	mg/L	<.010
Di-n-butyl phthalate	mg/L	<.010
Di-n-octyl phthalate	mg/L	<.010
Dibenzo(a,h)anthracene	mg/L	<.010
Diethyl phthalate	mg/L	<.010
Dimethyl phthalate	mg/L	<.010
Fluoranthene	mg/L	<.010

# DATA SUMMARY REPORT

DATE: 11/01/95

Company: OHM REMEDIATION SERVICES CORP.

PAGE: 10

Sample Point ID: P-1B  
 ASC Sample Number: JO9480  
 Sample Date: 951018  
 Facility Code: 018146T

Parameters Units

## Special Requested TCLP Leachate Semi-Volatile Analysis, MS, (MS47)

Fluorene	mg/L	<.010
Hexachlorobenzene	mg/L	<.010
Hexachlorobutadiene	mg/L	<.010
Hexachlorocyclopentadiene	mg/L	<.010
Hexachloroethane	mg/L	<.010
Indeno(1,2,3-cd)pyrene	mg/L	<.010
Isophorone	mg/L	<.010
N-Nitrosodi-n-propylamine	mg/L	<.010
N-Nitrosodimethylamine	mg/L	<.010
N-Nitrosodiphenylamine	mg/L	<.010
Naphthalene	mg/L	.019
Nitrobenzene	mg/L	<.010
Pentachlorophenol	mg/L	<.010
Phenanthrene	mg/L	<.010
Phenol	mg/L	.160
Pyrene	mg/L	<.010
bis(2-Chloroethoxy)methane	mg/L	<.010
bis(2-Chloroethyl) ether	mg/L	<.010
bis(2-Chloroisopropyl) ether	mg/L	<.010
bis(2-Ethylhexyl) phthalate	mg/L	<.010
p-Chloro-m-cresol	mg/L	<.010

# DATA SUMMARY REPORT

D. 11/01/95

Company: OHM REMEDIATION SERVICES CORP.

PAGE: 11

Sample Point ID: P-1B  
 ASC Sample Number: JO9821  
 Sample Date: 951018  
 Facility Code: 018146T

Parameters

Units

## Total Volatile Analysis, MS, (MV00)

Acetone	mg/kg	<24.3
Acrolein	mg/kg	<60.7
Acrylonitrile	mg/kg	<30.3
Benzene	mg/kg	<12.1
Bromoform	mg/kg	<12.1
Carbon disulfide	mg/kg	<12.1
Carbon tetrachloride	mg/kg	<12.1
Chlorobenzene	mg/kg	<12.1
Chlorodibromomethane	mg/kg	<12.1
Chloroethane	mg/kg	<12.1
Chloroform	mg/kg	<12.1
2-Chloroethylvinyl ether	mg/kg	<12.1
Dichlorobromomethane	mg/kg	<12.1
1,1-Dichloroethane	mg/kg	<12.1
1,2-Dichloroethane	mg/kg	<12.1
1,1-Dichloroethylene	mg/kg	<12.1
1,2-Dichloropropane	mg/kg	<12.1
cis-1,3-Dichloropropylene	mg/kg	<12.1
trans-1,3-Dichloropropylene	mg/kg	<12.1
Ethylbenzene	mg/kg	<12.1
Ethylene dibromide	mg/kg	<12.1
Ethyl acetate	mg/kg	<48.5
Ethyl ether	mg/kg	<12.1
2-Hexanone	mg/kg	<12.1
Methyl bromide	mg/kg	<12.1
Methyl chloride	mg/kg	<12.1
Methylene chloride	mg/kg	<12.1
Methyl ethyl ketone	mg/kg	<12.1
Methyl-iso-butyl ketone	mg/kg	<24.3
Styrene	mg/kg	<12.1
1,1,2,2-Tetrachloroethane	mg/kg	<12.1
Tetrachloroethylene	mg/kg	<12.1
Toluene	mg/kg	21.8
1,1,1-Trichloroethane	mg/kg	<12.1
1,1,2-Trichloroethane	mg/kg	<12.1

# DATA SUMMARY REPORT

DA. . 11/01/95

Company: OHM REMEDIATION SERVICES CORP.

PAGE: 12

Sample Point ID: P-1B  
ASC Sample Number: JO9821  
Sample Date: 951018  
Facility Code: 018146T

Parameters Units

## Total Volatile Analysis, MS, (MV00)

Trichloroethylene	mg/kg	<12.1
1,2-Trans-dichloroethylene	mg/kg	<12.1
Trichlorofluoromethane	mg/kg	<12.1
1,1,2-Trichlorotrifluoroethane	mg/kg	<24.3
Vinyl chloride	mg/kg	<12.1
Xylenes	mg/kg	<12.1

Sample Point ID: P-1B  
ASC Sample Number: JO9480  
Sample Date: 951018  
Facility Code: 018146T

Parameters Units

## Special Requested TCLP Leachate(ZHE) Volatile Analysis, MS, (MV53)

1,1,1-Trichloroethane	mg/L	<.050
1,1,2,2-Tetrachloroethane	mg/L	<.050
1,1,2-Trichloroethane	mg/L	<.050
1,1-Dichloroethane	mg/L	<.050
1,1-Dichloroethylene	mg/L	<.050
1,2-Dichloroethane	mg/L	<.050
1,2-Dichloropropane	mg/L	<.050
1,2-Trans-dichloroethylene	mg/L	<.050
2-Chloroethylvinyl ether	mg/L	<.050
Acrolein	mg/L	<.250
Acrylonitrile	mg/L	<.125
Benzene	mg/L	<.050
Bromoform	mg/L	<.050
Carbon tetrachloride	mg/L	<.050
Chlorobenzene	mg/L	<.050
Chlorodibromomethane	mg/L	<.050
Chloroethane	mg/L	<.050
Chloroform	mg/L	<.050
Dichlorobromomethane	mg/L	<.050

# DATA SUMMARY REPORT

DA . 11/01/95

Company: OHM REMEDIATION SERVICES CORP.

PAGE: 13

Sample Point ID: P-1B  
 ASC Sample Number: JO9480  
 Sample Date: 951018  
 Facility Code: 018146T

Parameters Units -

## Special Requested TCLP Leachate(ZHE) Volatile Analysis, MS, (MV53)

Ethylbenzene	mg/L	<.050
Methyl bromide	mg/L	<.050
Methyl chloride	mg/L	<.050
Methylene chloride	mg/L	.060
Tetrachloroethylene	mg/L	<.050
Toluene	mg/L	.064
Trichloroethylene	mg/L	<.050
Trichlorofluoromethane	mg/L	<.050
Vinyl chloride	mg/L	<.050
cis-1,3-Dichloropropylene	mg/L	<.050
trans-1,3-Dichloropropylene	mg/L	<.050

APPENDIX B

QUANTITATIVE RESULTS

# TARGET ANALYTE LIST TOTAL METALS ANALYSIS, (ME20)

Company Name	Facility	Sample Point	ASC Sample No.
OHM REMEDIATION SERVICES CORP.	018146T	P-1B	JO9821

Compounds	Sample Results mg/kg	Detection Limits mg/kg	Blank Results mg/kg	Batch Number
Aluminum	9950	9.85	ND	Q2M7253
Antimony	ND	3.94	ND	Q2M7253
Arsenic	ND	9.85	ND	Q2M7253
Barium	176	1.97	ND	Q2M7253
Beryllium	ND	1.97	ND	Q2M7253
Cadmium	ND	1.97	ND	Q2M7253
Calcium	281000	49.3	ND	Q2M7253
Chromium	125	1.97	ND	Q2M7253
Cobalt	22.0	9.85	ND	Q2M7253
Copper	161	1.97	ND	Q2M7253
Iron	39800	12.3	ND	Q2M7253
Lead	143	3.94	ND	Q2M7253
Magnesium	8920	49.3	ND	Q2M7253
Manganese	374	1.97	ND	Q2M7253
Mercury	.370	.035	ND	Q2G7252
Nickel	453	1.97	ND	Q2M7253
Potassium	2290	98.5	ND	Q2M7253
Selenium	ND	9.85	ND	Q2M7253
Silver	ND	1.97	ND	Q2M7253
Sodium	1540	49.3	ND	Q2M7253
Thallium	ND	9.85	ND	Q2M7253
Vanadium	1620	9.85	ND	Q2M7253
Zinc	303	1.97	ND	Q2M7253

TOTAL HERBICIDE ANALYSIS, GC, (GS02)

Company Name

Facility

Sample Point

ASC Sample No.

OHM REMEDIATION SERVICES CORP.

018146T

P-1B

JO9821

Compounds	Sample Results mg/kg	Detection Limits mg/kg	Blank Results mg/kg	Batch Number
2,4-D	ND	.093	ND	Q2H51522
2,4,5-T	ND	.093	ND	Q2H51522
2,4,5-TP (Silvex)	ND	.093	ND	Q2H51522

# TOTAL PESTICIDE AND PCB ANALYSIS, GC, (GS05)

Company Name	Facility	Sample Point	ASC Sample No.
OHM REMEDIATION SERVICES CORP.	018146T	P-1B	JO9821

Compounds	Sample Results mg/kg	Detection Limits mg/kg	Blank Results mg/kg	Batch Number
Aldrin	ND	.033	ND	Q2P51599
Alpha-BHC	ND	.033	ND	Q2P51599
Beta-BHC	ND	.033	ND	Q2P51599
Chlordane	ND	.331	ND	Q2P51599
4,4'-DDD	ND	.033	ND	Q2P51599
4,4'-DDE	ND	.033	ND	Q2P51599
4,4'-DDT	ND	.033	ND	Q2P51599
Delta-BHC	ND	.033	ND	Q2P51599
Dieldrin	ND	.033	ND	Q2P51599
Endosulfan sulfate	ND	.033	ND	Q2P51599
Endosulfan I	ND	.033	ND	Q2P51599
Endosulfan II	ND	.033	ND	Q2P51599
Endrin	ND	.033	ND	Q2P51599
Endrin aldehyde	ND	.033	ND	Q2P51599
Endrin ketone	ND	.033	ND	Q2P51599
Gamma-BHC	ND	.033	ND	Q2P51599
Heptachlor	ND	.033	ND	Q2P51599
Heptachlor epoxide	ND	.033	ND	Q2P51599
Methoxychlor	ND	.033	ND	Q2P51599
Toxaphene	ND	.662	ND	Q2P51599
Aroclor 1016	ND	.331	ND	Q2P51599
Aroclor 1221	ND	.331	ND	Q2P51599
Aroclor 1232	ND	.331	ND	Q2P51599
Aroclor 1242	ND	.331	ND	Q2P51599
Aroclor 1248	ND	.331	ND	Q2P51599
Aroclor 1254	ND	.331	ND	Q2P51599
Aroclor 1260	ND	.331	ND	Q2P51599

Surrogate recoveries which are outside of control limits were attributed to sample interferences at surrogate retention times.

# TOTAL BASE/NEUTRAL/ACID ANALYSIS, MS, (MS02)

Company Name	Facility	Sample Point	ASC Sample No.
OHM REMEDIATION SERVICES CORP.	018146T	P-1B	JO9821

Compounds	Sample Results mg/kg	Detection Limits mg/kg	Blank Results mg/kg	Batch Number
Acenaphthene	ND	4.00	ND	Q2C51597A
Acenaphthylene	ND	4.00	ND	Q2C51597A
Anthracene	ND	4.00	ND	Q2C51597A
Benzidine	ND	4.00	ND	Q2C51597A
Benzo(a)anthracene	ND	4.00	ND	Q2C51597A
Benzo(b)fluoranthene	ND	4.00	ND	Q2C51597A
Benzo(k)fluoranthene	ND	4.00	ND	Q2C51597A
Benzo(ghi)perylene	ND	4.00	ND	Q2C51597A
Benzo(a)pyrene	ND	4.00	ND	Q2C51597A
bis(2-Chloroethyl) ether	ND	4.00	ND	Q2C51597A
bis(2-Chloroethoxy)methane	ND	4.00	ND	Q2C51597A
bis(2-Chloroisopropyl) ether	ND	4.00	ND	Q2C51597A
bis(2-Ethylhexyl) phthalate	12.4	4.00	ND	Q2C51597A
4-Bromophenyl phenyl ether	ND	4.00	ND	Q2C51597A
Butyl benzyl phthalate	ND	4.00	ND	Q2C51597A
Carbazole	ND	4.00	ND	Q2C51597A
4-Chloroaniline	ND	4.00	ND	Q2C51597A
p-Chloro-m-cresol	ND	4.00	ND	Q2C51597A
2-Chloronaphthalene	ND	4.00	ND	Q2C51597A
2-Chlorophenol	ND	4.00	ND	Q2C51597A
4-Chlorophenyl phenyl ether	ND	4.00	ND	Q2C51597A
Chrysene	4.84	4.00	ND	Q2C51597A
benzo(a,h)anthracene	ND	4.00	ND	Q2C51597A
benzofuran	ND	4.00	ND	Q2C51597A
n-butyl phthalate	ND	4.00	ND	Q2C51597A
1,2-Dichlorobenzene	ND	4.00	ND	Q2C51597A
1,3-Dichlorobenzene	ND	4.00	ND	Q2C51597A
1,4-Dichlorobenzene	ND	4.00	ND	Q2C51597A
3,3'-Dichlorobenzidine	ND	4.00	ND	Q2C51597A
2,4-Dichlorophenol	ND	4.00	ND	Q2C51597A
Diethyl phthalate	ND	4.00	ND	Q2C51597A
Dimethyl phthalate	ND	4.00	ND	Q2C51597A
2,4-Dimethylphenol	ND	4.00	ND	Q2C51597A
4,6-Dinitro-o-cresol	ND	10.0	ND	Q2C51597A
2,4-Dinitrophenol	ND	20.0	ND	Q2C51597A
2,4-Dinitrotoluene	ND	4.00	ND	Q2C51597A
2,6-Dinitrotoluene	ND	4.00	ND	Q2C51597A
Di-n-octyl phthalate	ND	4.00	ND	Q2C51597A
Fluoranthene	ND	4.00	ND	Q2C51597A
Fluorene	ND	4.00	ND	Q2C51597A
Hexachlorobenzene	ND	4.00	ND	Q2C51597A
Hexachlorobutadiene	ND	4.00	ND	Q2C51597A
Hexachlorocyclopentadiene	ND	4.00	ND	Q2C51597A
Hexachloroethane	ND	4.00	ND	Q2C51597A
Indeno(1,2,3-cd)pyrene	ND	4.00	ND	Q2C51597A
Isophorone	ND	4.00	ND	Q2C51597A
2-Methylnaphthalene	22.7	4.00	ND	Q2C51597A
2-Methylphenol	ND	4.00	ND	Q2C51597A
4-Methylphenol	ND	4.00	ND	Q2C51597A
N-Nitrosodimethylamine	ND	4.00	ND	Q2C51597A

## TOTAL BASE/NEUTRAL/ACID ANALYSIS, MS, (MS02)

Company Name

Facility

Sample Point

ASC Sample No.

OHM REMEDIATION SERVICES CORP.

018146T

P-1B

JO9821

Compounds	Sample Results mg/kg	Detection Limits mg/kg	Blank Results mg/kg	Batch Number
N-Nitrosodi-n-propylamine	ND	4.00	ND	Q2C51597A
N-Nitrosodiphenylamine	ND	4.00	ND	Q2C51597A
Naphthalene	8.56	4.00	ND	Q2C51597A
2-Nitroaniline	ND	4.00	ND	Q2C51597A
3-Nitroaniline	ND	4.00	ND	Q2C51597A
4-Nitroaniline	ND	4.00	ND	Q2C51597A
Nitrobenzene	ND	4.00	ND	Q2C51597A
2-Nitrophenol	ND	4.00	ND	Q2C51597A
4-Nitrophenol	ND	20.0	ND	Q2C51597A
Pentachlorophenol	ND	4.00	ND	Q2C51597A
Phenanthrene	19.6	4.00	ND	Q2C51597A
Phenol	4.04	4.00	ND	Q2C51597A
Pyrene	6.44	4.00	ND	Q2C51597A
Pyridine	ND	4.00	ND	Q2C51597A
1,2,4-Trichlorobenzene	ND	4.00	ND	Q2C51597A
2,4,5-Trichlorophenol	ND	4.00	ND	Q2C51597A
2,4,6-Trichlorophenol	ND	4.00	ND	Q2C51597A

3-Methyl- and 4-Methylphenol coelute and are reported as the total

# SEMIVOLATILE TENTATIVELY IDENTIFIED COMPOUNDS, GC/MS, (CL1F)

Company Name

Facility

Sample Point

ASC Sample No.

OHM REMEDIATION SERVICES CORP.

018146T

P-1B

JO9821

Compounds	Sample Results mg/kg	Detection Limits mg/kg	Blank Results mg/kg	Batch Number
Unk hydrocarbon	17.5	-	-	Q2C51597A
Unk hydrocarbon	12.7	-	-	Q2C51597A
unknown	15.0	-	-	Q2C51597A
Unk hydrocarbon	16.2	-	-	Q2C51597A
Docosane	20.3	-	-	Q2C51597A
Dodecane	24.3	-	-	Q2C51597A
Hexadecane	34.0	-	-	Q2C51597A
Hexadecane	53.7	-	-	Q2C51597A
Hexadecane	21.4	-	-	Q2C51597A
Tetradecane	11.9	-	-	Q2C51597A
Tetradecane	35.3	-	-	Q2C51597A
Tridecane	33.6	-	-	Q2C51597A
Tridecane	30.4	-	-	Q2C51597A
Nonadecane	28.9	-	-	Q2C51597A
Heptadecane	33.9	-	-	Q2C51597A
Naphthalene, 2,3-dimethyl-	23.1	-	-	Q2C51597A
Eicosane	27.3	-	-	Q2C51597A
Pentadecane	44.3	-	-	Q2C51597A
Dodecane, 2-methyl-6-propyl-	13.8	-	-	Q2C51597A
Undecane	20.8	-	-	Q2C51597A
Tridecane, 7-methyl-	19.1	-	-	Q2C51597A
Naphthalene, 1,4,6-trimethyl-	18.0	-	-	Q2C51597A
Undecane, 2,6-dimethyl-	13.6	-	-	Q2C51597A
hexane, 2-butyl-1,1,3-tri	15.5	-	-	Q2C51597A
Methano-1H-indene, 3a,4,7,	16.9	-	-	Q2C51597A
Naphthalene, 1-ethyl-	23.0	-	-	Q2C51597A
Heptadecane, 2,6-dimethyl-	60.0	-	-	Q2C51597A
Pentadecane, 8-hexyl-	14.4	-	-	Q2C51597A
Dodecane, 2,6,10-trimethyl-	24.4	-	-	Q2C51597A
Dodecane, 2,7,10-trimethyl-	45.4	-	-	Q2C51597A

The results listed above for the Tentatively Identified Compounds are considered estimated concentrations since a 1:1 response is assumed.

# TOTAL VOLATILE ANALYSIS, MS, (MV00)

Company Name	Facility	Sample Point	ASC Sample No.
OHM REMEDIATION SERVICES CORP.	018146T	P-13	JO9821

Compounds	Sample Results mg/kg	Detection Limits mg/kg	Blank Results mg/kg	Batch Number
Acetone	ND	24.3	ND	Q2V4746
Acrolein	ND	60.7	ND	Q2V4746
Acrylonitrile	ND	30.3	ND	Q2V4746
Benzene	ND	12.1	ND	Q2V4746
Bromoform	ND	12.1	ND	Q2V4746
Carbon disulfide	ND	12.1	ND	Q2V4746
Carbon tetrachloride	ND	12.1	ND	Q2V4746
Chlorobenzene	ND	12.1	ND	Q2V4746
Chlorodibromomethane	ND	12.1	ND	Q2V4746
Chloroethane	ND	12.1	ND	Q2V4746
Chloroform	ND	12.1	ND	Q2V4746
2-Chloroethylvinyl ether	ND	12.1	ND	Q2V4746
Dichlorobromomethane	ND	12.1	ND	Q2V4746
1,1-Dichloroethane	ND	12.1	ND	Q2V4746
1,2-Dichloroethane	ND	12.1	ND	Q2V4746
1,1-Dichloroethylene	ND	12.1	ND	Q2V4746
1,2-Dichloropropane	ND	12.1	ND	Q2V4746
cis-1,3-Dichloropropylene	ND	12.1	ND	Q2V4746
trans-1,3-Dichloropropylene	ND	12.1	ND	Q2V4746
Ethylbenzene	ND	12.1	ND	Q2V4746
Ethylene dibromide	ND	12.1	ND	Q2V4746
Ethyl acetate	ND	49.5	ND	Q2V4746
Ethyl ether	ND	12.1	ND	Q2V4746
Hexanone	ND	12.1	ND	Q2V4746
Ethyl bromide	ND	12.1	ND	Q2V4746
Methyl chloride	ND	12.1	ND	Q2V4746
Methylene chloride	ND	12.1	ND	Q2V4746
Methyl ethyl ketone	ND	12.1	ND	Q2V4746
Methyl-iso-butyl ketone	ND	24.3	ND	Q2V4746
Styrene	ND	12.1	ND	Q2V4746
1,1,2,2-Tetrachloroethane	ND	12.1	ND	Q2V4746
Tetrachloroethylene	ND	12.1	ND	Q2V4746
Toluene	21.8	12.1	ND	Q2V4746
1,1,1-Trichloroethane	ND	12.1	ND	Q2V4746
1,1,2-Trichloroethane	ND	12.1	ND	Q2V4746
Trichloroethylene	ND	12.1	ND	Q2V4746
1,2-Trans-dichloroethylene	ND	12.1	ND	Q2V4746
Trichlorofluoromethane	ND	12.1	ND	Q2V4746
1,1,2-Trichlorotrifluoroethane	ND	24.3	ND	Q2V4746
Vinyl chloride	ND	12.1	ND	Q2V4746
Xylenes	ND	12.1	ND	Q2V4746

These reporting limits are higher than usual due to matrix interferences.

# VOLATILE TENTATIVELY IDENTIFIED COMPOUNDS , GC/MS, (CL1E)

Company Name

Facility

Sample Point

ASC Sample No.

OHM REMEDIATION SERVICES CORP.

018146T

P-1B

JO9821

Compounds	Sample Results mg/kg	Detection Limits mg/kg	Blank Results mg/kg	Batch Number
unknown	37.1	-	-	Q2V4746
unknown	33.4	-	-	Q2V4746
Decane	15.0	-	-	Q2V4746
Decanedioic acid, ester isomer	41.6	-	-	Q2V4746
Decanedioic acid, ester isomer	14.3	-	-	Q2V4746
Decanedioic acid, ester isomer	18.7	-	-	Q2V4746
4,7-Methano-1H-indene, 3a,4,7,	30.9	-	-	Q2V4746
Naphthalene, 2-methyl-	14.0	-	-	Q2V4746

The results listed above for the Tentatively Identified Compounds are considered estimated concentrations since a 1:1 response is assumed.

## RCRA TCLP LEACHATE HERBICIDE ANALYSIS, GC, (GS52)

Company Name

Facility

Sample Point

ASC Sample No.

OHM REMEDIATION SERVICES CORP.

018146T

P-13

JO9480

Compounds	Sample Results mg/L	Detection Limits mg/L	Blank Results mg/L	Batch Number
2,4-D	ND	.0005	ND	Q7H51539
2,4,5-TP (Silvex)	ND	.0005	ND	Q7H51539

# TCLP PESTICIDE AND PCB ANALYSIS, GC, (GS55)

Company Name	Facility	Sample Point	ASC Sample No.
CHM REMEDIATION SERVICES CORP.	018146T	P-13	JO9480

Compounds	Sample Results mg/L	Detection Limits mg/L	Blank Results mg/L	Batch Number
Aldrin	ND	.0001	ND	Q7P51537
Alpha-BHC	ND	.0001	ND	Q7P51537
Beta-BHC	ND	.0001	ND	Q7P51537
Chlordane	ND	.001	ND	Q7P51537
4,4'-DDD	ND	.0001	ND	Q7P51537
4,4'-DDE	ND	.0001	ND	Q7P51537
4,4'-DDT	ND	.0001	ND	Q7P51537
Delta-BHC	ND	.0001	ND	Q7P51537
Dieldrin	ND	.0001	ND	Q7P51537
Endosulfan sulfate	ND	.0001	ND	Q7P51537
Endosulfan I	ND	.0001	ND	Q7P51537
Endosulfan II	ND	.0001	ND	Q7P51537
Endrin	ND	.0001	ND	Q7P51537
Endrin aldehyde	ND	.0001	ND	Q7P51537
Gamma-BHC	ND	.0001	ND	Q7P51537
Heptachlor	ND	.0001	ND	Q7P51537
Heptachlor epoxide	ND	.0001	ND	Q7P51537
Toxaphene	ND	.002	ND	Q7P51537
Methoxychlor	ND	.0001	ND	Q7P51537
Aroclor 1016	ND	.001	ND	Q7P51537
Aroclor 1221	ND	.001	ND	Q7P51537
Aroclor 1232	ND	.001	ND	Q7P51537
Aroclor 1242	ND	.001	ND	Q7P51537
lor 1248	ND	.001	ND	Q7P51537
lor 1254	ND	.001	ND	Q7P51537
Aroclor 1260	ND	.001	ND	Q7P51537

# SPECIAL REQUESTED LEACHATE METALS ANALYSIS, (ME42)

Company Name	Facility	Sample Point	ASC Sample No.
OHM REMEDIATION SERVICES CORP.	018146T	P-13	JO9480

Compounds	Sample Results mg/L	Detection Limits mg/L	Blank Results mg/L	Batch Number
Aluminum	ND	.100	ND	Q7M7213
Antimony	ND	.060	ND	Q7M7213
Arsenic	ND	.100	ND	Q7M7213
Barium	.197	.100	ND	Q7M7213
Beryllium	ND	.005	ND	Q7M7213
Cadmium	ND	.005	ND	Q7M7213
Calcium	696	1.00	ND	Q7M7213
Chromium	ND	.020	ND	Q7M7213
Cobalt	ND	.020	ND	Q7M7213
Copper	.044	.020	ND	Q7M7213
Iron	ND	.100	ND	Q7M7213
Lead	ND	.100	ND	Q7M7213
Magnesium	10.5	1.00	ND	Q7M7213
Manganese	ND	.010	ND	Q7M7213
Mercury	ND	.001	ND	Q7G7209
Molybdenum	.286	.020	ND	Q7M7213
Nickel	.212	.040	ND	Q7M7213
Potassium	20.2	2.00	ND	Q7M7213
Selenium	ND	.100	ND	Q7M7213
Silver	ND	.020	ND	Q7M7213
Sodium	4320	1.00	ND	Q7M7213
Thallium	ND	.100	ND	Q7M7213
Vanadium	4.69	.020	ND	Q7M7213
c	ND	.200	ND	Q7M7213

SODIUM RESULT IS QUALITATIVE ONLY.

## SPECIAL REQUESTED TCLP LEACHATE SEMI-VOLATILE ANALYSIS, MS, (MS47)

Company Name	Facility	Sample Point	ASC Sample No.
OHM REMEDIATION SERVICES CORP.	018146T	P-1B	JO9480

Compounds	Sample Results mg/L	Detection Limits mg/L	Blank Results mg/L	Batch Number
1,2,4-Trichlorobenzene	ND	.010	ND	Q7C51536
1,2-Dichlorobenzene	ND	.010	ND	Q7C51536
1,3-Dichlorobenzene	ND	.010	ND	Q7C51536
1,4-Dichlorobenzene	ND	.010	ND	Q7C51536
2,4,6-Trichlorophenol	ND	.010	ND	Q7C51536
2,4-Dichlorophenol	ND	.010	ND	Q7C51536
2,4-Dimethylphenol	.023	.010	ND	Q7C51536
2,4-Dinitrophenol	ND	.050	ND	Q7C51536
2,4-Dinitrotoluene	ND	.010	ND	Q7C51536
2,6-Dinitrotoluene	ND	.010	ND	Q7C51536
2-Chloronaphthalene	ND	.010	ND	Q7C51536
2-Chlorophenol	ND	.010	ND	Q7C51536
2-Nitrophenol	ND	.010	ND	Q7C51536
3,3'-Dichlorobenzidine	ND	.010	ND	Q7C51536
4,6-Dinitro-o-cresol	ND	.025	ND	Q7C51536
4-Bromophenyl phenyl ether	ND	.010	ND	Q7C51536
4-Chlorophenyl phenyl ether	ND	.010	ND	Q7C51536
4-Nitrophenol	ND	.050	ND	Q7C51536
Acenaphthene	ND	.010	ND	Q7C51536
Acenaphthylene	ND	.010	ND	Q7C51536
Anthracene	ND	.010	ND	Q7C51536
Benzidine	ND	.010	ND	Q7C51536
Benzo(a)anthracene	ND	.010	ND	Q7C51536
Benzo(a)pyrene	ND	.010	ND	Q7C51536
Benzo(b)fluoranthene	ND	.010	ND	Q7C51536
Benzo(ghi)perylene	ND	.010	ND	Q7C51536
Benzo(k)fluoranthene	ND	.010	ND	Q7C51536
bis(2-Chloroethoxy)methane	ND	.010	ND	Q7C51536
bis(2-Chloroethyl) ether	ND	.010	ND	Q7C51536
bis(2-Chloroisopropyl) ether	ND	.010	ND	Q7C51536
bis(2-Ethylhexyl)phthalate	ND	.010	ND	Q7C51536
Butyl benzyl phthalate	ND	.010	ND	Q7C51536
Chrysene	ND	.010	ND	Q7C51536
Di-n-butyl phthalate	ND	.010	ND	Q7C51536
Di-n-octyl phthalate	ND	.010	ND	Q7C51536
Dibenzo(a,h)anthracene	ND	.010	ND	Q7C51536
Diethyl phthalate	ND	.010	ND	Q7C51536
Dimethyl phthalate	ND	.010	ND	Q7C51536
Fluoranthene	ND	.010	ND	Q7C51536
Fluorene	ND	.010	ND	Q7C51536
Hexachlorobenzene	ND	.010	ND	Q7C51536
Hexachlorobutadiene	ND	.010	ND	Q7C51536
Hexachlorocyclopentadiene	ND	.010	ND	Q7C51536
Hexachloroethane	ND	.010	ND	Q7C51536
Indeno(1,2,3-cd)pyrene	ND	.010	ND	Q7C51536
Isophorone	ND	.010	ND	Q7C51536
N-Nitrosodi-n-propylamine	ND	.010	ND	Q7C51536
N-Nitrosodimethylamine	ND	.010	ND	Q7C51536
N-Nitrosodiphenylamine	ND	.010	ND	Q7C51536
Naphthalene	.019	.010	ND	Q7C51536

# SPECIAL REQUESTED TCLP LEACHATE SEMI-VOLATILE ANALYSIS, MS, (MS47)

Company Name

Facility

Sample Point

ASC Sample No.

OHM REMEDIATION SERVICES CORP.

018146T

P-1B

JO9480

Compounds	Sample Results mg/L	Detection Limits mg/L	Blank Results mg/L	Batch Number
Nitrobenzene	ND	.010	ND	Q7C51536
p-Chloro-m-cresol	ND	.010	ND	Q7C51536
Pentachlorophenol	ND	.010	ND	Q7C51536
Phenanthrene	ND	.010	ND	Q7C51536
Phenol	.160	.010	ND	Q7C51536
Pyrene	ND	.010	ND	Q7C51536

## SPECIAL REQUESTED TCLP LEACHATE(ZHE) VOLATILE ANALYSIS, MS, (MV53)

Company Name

Facility

Sample Point

ASC Sample No.

OHM REMEDIATION SERVICES CORP.

018146T

P-1B

J09480

Compounds	Sample Results mg/L	Detection Limits mg/L	Blank Results mg/L	Batch Number
1,1,1-Trichloroethane	ND	.050	ND	Q7V4732
1,1,2,2-Tetrachloroethane	ND	.050	ND	Q7V4732
1,1,2-Trichloroethane	ND	.050	ND	Q7V4732
1,1-Dichloroethane	ND	.050	ND	Q7V4732
1,1-Dichloroethylene	ND	.050	ND	Q7V4732
1,2-Dichloroethane	ND	.050	ND	Q7V4732
1,2-Dichloropropane	ND	.050	ND	Q7V4732
1,2-Trans-dichloroethylene	ND	.050	ND	Q7V4732
2-Chloroethylvinyl ether	ND	.050	ND	Q7V4732
Acrolein	ND	.250	ND	Q7V4732
Acrylonitrile	ND	.125	ND	Q7V4732
Benzene	ND	.050	ND	Q7V4732
Bromoform	ND	.050	ND	Q7V4732
Carbon tetrachloride	ND	.050	ND	Q7V4732
Chlorobenzene	ND	.050	ND	Q7V4732
Chlorodibromomethane	ND	.050	ND	Q7V4732
Chloroethane	ND	.050	ND	Q7V4732
Chloroform	ND	.050	ND	Q7V4732
cis-1,3-Dichloropropylene	ND	.050	ND	Q7V4732
Dichlorobromomethane	ND	.050	ND	Q7V4732
Ethylbenzene	ND	.050	ND	Q7V4732
Methyl bromide	ND	.050	ND	Q7V4732
Methyl chloride	ND	.050	ND	Q7V4732
Vinyl chloride	.060	.050	ND	Q7V4732
1,1-Dichloroethylene	ND	.050	ND	Q7V4732
Toluene	.064	.050	ND	Q7V4732
trans-1,3-Dichloropropylene	ND	.050	ND	Q7V4732
Trichloroethylene	ND	.050	ND	Q7V4732
Trichlorofluoromethane	ND	.050	ND	Q7V4732
Vinyl chloride	ND	.050	ND	Q7V4732

## APPENDIX C

### QUALITY ASSURANCE DATA

# QUALITY ASSURANCE REPORT

Compound(s)		METHOD SPIKE					MATRIX SPIKE						SPIKE DUPLICATE					% COMPLETE	
		Blank Conc.	Added Conc.	Spiked Conc.	✓ Rec.	Rec. Limits	Spiked Sample Id.	Unspk Conc.	Added Conc.	Spiked Conc.	✓ Rec.	Rec. Limits	Added Conc.	Spiked Conc.	✓ Rec.	RPD	RPD Limit	Batch #	✓
1,2,4-Trichlorobenzene	mg/kg	0	4.00	2.54	64	52-110L 44-142M	P-1B	0	3.97	2.49	63	46-110L 44-142M	3.91	2.26	58	8	0-20L	Q2C51597A	73L 88M
1,4-Dichlorobenzene	mg/kg	0	4.00	2.70	68	47-110L 20-124M	P-1B	0	3.97	2.58	65	39-110L 20-124M	3.91	2.00	51	24 L	0-23L		
2,4-Dinitrotoluene	mg/kg	0	4.00	2.62	66	57-112L 39-139M	P-1B	0	3.97	3.83	96	46-117L 39-139M	3.91	4.02	103	7	0-17L		
2-Chlorophenol	mg/kg	0	6.00	4.12	69	45-110L 23-134M	P-1B	0	5.95	2.69	45	41-110L 23-134M	5.86	1.70	29 L	43 L	0-19L		
4-Nitrophenol	mg/kg	0	6.00	4.01	67	52-114L 1-132M	P-1B	0	5.95	2.29	38 L	50-119L 1-132M							
Acenaphthene	mg/kg	0	4.00	2.72	68	56-111L 47-145M	P-1B	0	3.97	5.95	150M	51-121L 47-145M	3.91	5.78	148M	1	0-16L		
Isophorone	mg/kg	0	4.00	2.58	65	53-110L 21-196M	P-1B	0	3.97	3.20	81	53-110L	3.91	2.77	71	13	0-30L		
N-Nitrosodi-n-propylamine	mg/kg	0	4.00	2.65	66	45-110L 1-230M	P-1B	0	3.97	2.60	65	35-115L 1-230M	3.91	1.82	47	32 L	0-21L		
Pentachlorophenol	mg/kg	0	6.00	3.17	53	42-130L 14-176M	P-1B	0	5.95	0	0 M	36-135L 14-176M							
Phenol	mg/kg	0	6.00	4.06	68	42-110L 5-112M	P-1B	4.04	5.95	8.61	77	40-111L 5-112M	5.86	6.76	46	50 L	0-19L		
Pyrene	mg/kg	0	4.00	2.67	67	58-118L 52-115M	P-1B	6.44	3.97	8.41	50 M	55-128L 52-115M	3.91	8.52	53 L	6	0-27L		
p-Chloro-m-cresol	mg/kg	0	6.00	4.02	67	51-110L 22-147M	P-1B	0	5.95	3.10	52	51-110L 22-147M	5.86	2.73	47 L	10	0-17L		
2,4,5-T	mg/kg	0	1.00	.951	95	63-139L	P-1B	0	.847	.648	77	56-144L	.897	.781	87	12	0-20L	Q2H51522	100L
2,4,5-TP (Silvex)	mg/kg	0	1.00	.934	93	63-143L	P-1B	0	.847	.739	87	53-148L	.897	.787	88	1	0-20L		
2,4-D	mg/kg	0	1.00	.967	97	71-132L	P-1B	0	.847	.796	94	64-144L	.897	.915	102	8	0-20L		
4,4'-DDD	mg/kg	0	.167	.183	110	64-118L 31-141M	P-1B	0	.163	.132	81	49-111L 31-141M	.166	.146	88	8	0-24L	Q2P51599	81L 96M
4,4'-DDE	mg/kg	0	.167	.178	107	65-118L 30-145M	P-1B	0	.163	.108	66	48-126L 30-145M	.166	.108	65	2	0-25L		
4,4'-DDT	mg/kg	0	.167	.185	111	70-128L 25-160M	P-1B	0	.163	.129	79	46-140L 25-160M	.166	1.58	952M	169L	0-23L		
Aldrin	mg/kg	0	.167	.158	95	57-110L 42-122M	P-1B	0	.163	.0859	53	44-123L 42-122M	.166	.0907	55	4	0-25L		
Alpha-BHC	mg/kg	0	.167	.180	108	56-110L 37-134M	P-1B	0	.163	.0980	60	39-111L 37-134M	.166	.100	60	0	0-22L		
Beta-BHC	mg/kg	0	.167	.153	92	62-111L 17-147M	P-1B	0	.163	.0980	60	43-133L 17-147M	.166	.111	67	11	0-22L		
Chlordane	mg/kg	0	.333	.333	100	64-112L 45-119M	P-1B	0	.327	.168	51 L	53-131L 45-119M	.331	.183	55	8	0-23L		
Delta-BHC	mg/kg	0	.167	.198	119L	53-115L 32-137M	P-1B	0	.163	.0771	47	30-127L 32-137M	.166	.0897	54	14	0-20L		
Dieldrin	mg/kg	0	.167	.173	104	64-119L 36-146M	P-1B	0	.163	.0680	42 L	47-131L 36-146M	.166	.0735	44 L	5	0-20L		
Endosulfan I	mg/kg	0	.167	.172	103	67-112L 45-153M	P-1B	0	.163	.102	63	54-131L 45-153M	.166	.105	63	0	0-21L		
Endosulfan II	mg/kg	0	.167	.129	77	48-117L 1-202M	P-1B	0	.163	.111	68	47-126L 1-202M	.166	.394	237M	111L	0-21L		

Compound(s)		METHOD SPIKE					MATRIX SPIKE						SPIKE DUPLICATE					% COMPLETE	
		Blank Conc.	Added Conc.	Spiked Conc.	% Rec.	Rec. Limits	Spiked Sample Id.	Unspk Conc.	Added Conc.	Spiked Conc.	% Rec.	Rec. Limits	Added Conc.	Spiked Conc.	% Rec.	RPD	RPD Limit	Batch #	%
Endosulfan sulfate	mg/kg	0	.167	.126	75	39-119L 26-144M	P-1B	0	.163	.0850	52	34-114L 26-144M	.166	.0930	56	7	0-26L		
Endrin	mg/kg	0	.167	.187	112	64-118L 30-147M	P-1B	0	.163	.115	71	57-121L 30-147M	.166	.109	66	7	0-22L		
Endrin aldehyde	mg/kg	0	.167	.0988	59	33-110L	P-1B	0	.163	.0283	17 L	27-110L	.166	.0320	19 L	11	0-28L		
Endrin ketone	mg/kg	0	.167	.155	93	47-121L	P-1B	0	.163	.0810	50	41-118L	.166	.0854	51	2	0-30L		
Gamma-BHC	mg/kg	0	.167	.172	103	54-110L 32-127M	P-1B	0	.163	.160	98	42-118L 32-127M	.166	.164	99	1	0-23L		
Heptachlor	mg/kg	0	.167	.154	92	57-110L 34-111M	P-1B	0	.163	.0680	42 L	54-131L 34-111M	.166	.0712	43 L	2	0-21L		
Heptachlor epoxide	mg/kg	0	.167	.163	98	63-113L 37-142M	P-1B	0	.163	.113	69	57-133L 37-142M	.166	.109	66	4	0-23L		
Lindane	mg/kg	0	.167	.172	103	55-110L 32-127M	P-1B	0	.163	.160	98	42-117L 32-127M	.166	.164	99	1	0-23L		
Methoxychlor	mg/kg	0	.167	.173	104	62-133L	P-1B	0	.163	.0797	49 L	53-138L	.166	.0808	49 L	0	0-21L		
Alpha-Chlordane	mg/kg	0	.167	.167	100	67-110L 45-119M	P-1B	0	.163	.0856	53 L	54-134L 45-119M	.166	.0934	56	6	0-24L		
gamma-Chlordane	mg/kg	0	.167	.166	99	67-111L 45-119M	P-1B	0	.163	.0827	51 L	57-130L 45-119M	.166	.0901	54 L	6	0-23L		
1,1-Dichloroethylene	mg/kg	0	50.0	50.3	101	76-118L 1-234M	P-1B	0	121	139	115	80-117L 1-234M	121	132	109	5	0-13L	Q2V4746	100L 100M
1,2-cis-Dichloroethylene	mg/kg	0	50.0	53.4	107	81-120L	P-1B	0	121	136	112	83-120L	121	134	111	.9	0-9 L		
Benzene	mg/kg	.0630	50.0	50.4	101	87-114L 37-151M	P-1B	1.87	121	127	103	89-116L 37-151M	121	122	99	4	0-8 L		
Chlorobenzene	mg/kg	.0610	50.0	48.6	97	86-112L 37-160M	P-1B	0	121	127	105	86-112L 37-160M	121	120	99	6	0-11L		
Toluene	mg/kg	.0720	50.0	48.2	96	84-114L 47-150M	P-1B	21.8	121	147	103	83-121L 47-150M	121	138	96	7	0-15L		
Trichloroethylene	mg/kg	.0730	50.0	49.1	98	87-113L 71-157M	P-1B	0	121	125	103	83-117L 71-157M	121	122	101	2	0-8 L		
2,4-Dinitrotoluene	mg/l	0	.100	.0743	74	49-134L 39-139M												Q7C51536	100L 100M
Acenaphthene	mg/l	0	.100	.0720	72	30-130L 47-145M													
Pentachlorophenol	mg/l	0	.150	.133	89	43-140L 14-176M													
Pyrene	mg/l	0	.100	.0710	71	30-130L 52-115M													
2,4,5-TP (Silvex)	mg/l	0	.00400	.00395	99	60-124L												Q7H51539	100L
2,4-D	mg/l	0	.0200	.0149	75	45-126L													
4,4'-DDD	mg/l	0	.00100	9.-04	90	30-130L												Q7F51537	86L
4,4'-DDE	mg/l	0	.00100	8.-04	83	30-130L													
4,4'-DDT	mg/l	0	.00100	9.-04	88	30-130L													

# QUALITY ASSURANCE REPORT

Compound(s)		SAMPLE DUPLICATE					POST SPIKE						ICP SERIAL DILUTION					Batch #
		Sample Id.	Sample Conc.	Dup. Conc.	RPD	RPD Limit	Spiked Sample Id.	Unspk Conc. mg/l	Added Conc. mg/l	Spiked Conc. mg/l	% Rec.	Rec. Limits	Sample Id.	Sample Conc. mg/l	Dil. Conc. mg/l	% Diff	Limit	
Mercury	mg/kg	P-1B	.370	.365	1	0-20M												Q2G7252
Aluminum	mg/kg	P-1B	9950	9850	1	0-20M							P-1B	202	199	1	0-10M	Q2M7253
Antimony	mg/kg	P-1B	1.47	1.18									P-1B	.0299	.0280			Q2M7253
Arsenic	mg/kg	P-1B	7.83	9.95	24 M	0-20M							P-1B	.159	.142	11		Q2M7253
Barium	mg/kg	P-1B	176	185	5	0-20M							P-1B	3.57	3.34	6	0-10M	Q2M7253
Beryllium	mg/kg	P-1B	-.813	-.830			P-1B	0	.209	.166	79	75-125M	P-1B	-.0165	-.0151			Q2M7253
Cadmium	mg/kg	P-1B	.837	.880	5	0-20M							P-1B	.0170	.0170	0		Q2M7253
Calcium	mg/kg	P-1B	281000	285000	1	0-20M							P-1B	5700	4570	20 M	0-10M	Q2M7253
Chromium	mg/kg	P-1B	125	126	.8	0-20M							P-1B	2.54	2.61	3	0-10M	Q2M7253
Cobalt	mg/kg	P-1B	22.0	22.6	3	0-20M							P-1B	.446	.454	2	0-10M	Q2M7253
Copper	mg/kg	P-1B	161	161	0	0-20M							P-1B	3.26	3.17	3	0-10M	Q2M7253
Iron	mg/kg	P-1B	19800	41900	5	0-20M							P-1B	807	735	9	0-10M	Q2M7253
Lead	mg/kg	P-1B	143	141	1	0-20M							P-1B	2.90	3.00	3	0-10M	Q2M7253
Magnesium	mg/kg	P-1B	8920	9100	2	0-20M							P-1B	181	182	.6	0-10M	Q2M7253
Manganese	mg/kg	P-1B	374	391	4	0-20M							P-1B	7.60	7.75	2	0-10M	Q2M7253
Nickel	mg/kg	P-1B	453	456	.7	0-20M							P-1B	9.20	9.65	5	0-10M	Q2M7253
Potassium	mg/kg	P-1B	2290	2350	3	0-20M							P-1B	46.4	41.3	11 M	0-10M	Q2M7253
Selenium	mg/kg	P-1B	.961	1.97	2 M	.20M							P-1B	.0195	-.119			Q2M7253
Silver	mg/kg	P-1B	-3.90	-4.20			P-1B	0	.144	0	0 M	75-125M	P-1B	-.0792	-.134			Q2M7253
Sodium	mg/kg	P-1B	1540	1580	3	0-20M							P-1B	31.2	29.6	5	0-10M	Q2M7253
Thallium	mg/kg	P-1B	-6.95	-7.80									P-1B	-.141	-.0880			Q2M7253
Vanadium	mg/kg	P-1B	1620	1650	2	0-20M							P-1B	32.9	32.9	0	0-10M	Q2M7253
Zinc	mg/kg	P-1B	303	317	5	0-20M							P-1B	6.15	6.05	2	0-10M	Q2M7253
Mercury	mg/l	P-1B	2.05	5.05														Q7G7209
Aluminum	mg/l	P-1B	-.233	-.238									P-1B	-.233	-.324			Q7M7213
Antimony	mg/l	P-1B	.00996	.0127									P-1B	.00996	-.0620			Q7M7213
Arsenic	mg/l	P-1B	.0279	.00700	.028								P-1B	.0279	.0454	100		Q7M7213
Barium	mg/l	P-1B	.197	.212	.015	.10M							P-1B	.197	.212	8	0-10M	Q7M7213
Beryllium	mg/l	P-1B	.00322	.00309	NVR*		P-1B	.00322	.975	.938	96	75-125M	P-1B	.00322	.00495	54		Q7M7213
Cadmium	mg/l	P-1B	6.04	1.05									P-1B	6.04	4.04			Q7M7213
Calcium	mg/l	P-1B	696	745	7	0-20M							P-1B	696	775	11 M	0-10M	Q7M7213
Chromium	mg/l	P-1B	.00476	.00621	.001								P-1B	.00476	4.03	100		Q7M7213
Cobalt	mg/l	P-1B	.00720	.00734	NVR*								P-1B	.00720	.00425	100		Q7M7213
Copper	mg/l	P-1B	.0439	.0494	.006	.020M							P-1B	.0439	.0415	5		Q7M7213
Iron	mg/l	P-1B	.0572	.0567									P-1B	.0572	.0995			Q7M7213
Lead	mg/l	P-1B	.0122	.0229	.023								P-1B	.0122	-.0265			Q7M7213
Magnesium	mg/l	P-1B	10.5	11.3	7	0-20M							P-1B	10.5	11.8	12 M	0-10M	Q7M7213
Manganese	mg/l	P-1B	.00322	.00286	NVR*								P-1B	.00322	.00500	100		Q7M7213
Molybdenum	mg/l	P-1B	.286	.307	7	0-20M							P-1B	.286	.320	12 M	0-10M	Q7M7213
Nickel	mg/l	P-1B	.212	.233	9	0-20M							P-1B	.212	.244	15		Q7M7213
Potassium	mg/l	P-1B	20.2	22.1	9	0-20M							P-1B	20.2	20.4	1		Q7M7213
Selenium	mg/l	P-1B	-.0190	.00551									P-1B	-.0190	-.105			Q7M7213
Silver	mg/l	P-1B	-.0102	-3.03									P-1B	-.0102	-.0206			Q7M7213
Sodium	mg/l	P-1B	4320	4320	0	0-20M							P-1B	4320	1510	65 M	0-10M	Q7M7213
Thallium	mg/l	P-1B	.00840	.00740									P-1B	.00840	.00510			Q7M7213
Vanadium	mg/l	P-1B	4.69	5.06	8	0-20M							P-1B	4.69	5.20	11 M	0-10M	Q7M7213
Zinc	mg/l	P-1B	.0269	.0244	.003								P-1B	.0269	.0432	61		Q7M7213

## METHODOLOGY REFERENCES

---

- ASTM      *American Society for Testing and Materials*, 1985 edition.
- MCAWW    *Methods for Chemical Analysis of Water and Wastes*, April 1979 and Updated #1 March 1983.
- CLP        *USEPA Contract Laboratory Program*, Document #OLMO3.0, update August 1994 #OLMO3.1 and Document #ILMO4.0.
- EPA-500   *USEPA Methods for the Determination of Organic Compounds in Drinking Water*, EPA-600/4-88/039 December 1988.
- EPA-600   *USEPA Test Methods for Organic Chemical Analysis of Municipal and Industrial Wastewater*, EPA-600/4-82-057 July 1982.
- NIOSH     *National Institute for Occupational Safety and Health*, 3rd edition, 1984.
- SMEWW    *Standard Methods for the Examination of Water and Wastewater*, 17th edition, 1989.
- STOA      *Spot Tests In Organic Analysis*, 7th edition, 1966.
- SW-846    *Test Methods for Evaluating Solid Wastes, Physical/Chemical Methods*, 3rd edition, September 1986 and Update #1 July 1992.
- (1)        This method was modified to incorporate the use of Boron Trifluoride (BF<sub>3</sub>) as the derivatizing reagent according to Method 6640 in *SMEWW*, 17th edition, 1989.
- Title 22    *Waste Extraction Test*, Title 22, Section 66261.126 Appendix 2 of the California Administrative Code, May 1991.

# CHAIN-OF-CUSTODY RECORD

LAB COPY

Form 0019  
 Field Technical Services  
 Rev. 08/89

169415

O.H. MATERIALS CORP. • P.O. BOX 551 • FINDLAY, OH 45839-0551 • 419-423-3526

PROJECT NAME <i>Protego</i>		PROJECT LOCATION		ANALYSIS DESIRED (INDICATE SEPARATE CONTAINERS) <i>Sub Aet</i>	
PROJ. NO. <i>18146</i>	PROJECT CONTACT	PROJECT TELEPHONE NO. <i>X-4105</i>			
CLIENT'S REPRESENTATIVE		PROJECT MANAGER/SUPERVISOR			

ITEM NO.	SAMPLE NUMBER	DATE	TIME	COMP	GRAB	SAMPLE DESCRIPTION (INCLUDE MATRIX AND POINT OF SAMPLE)	NUMBER OF CONTAINERS	REMARKS
1	<i>PIB</i>	<i>10-18-95</i>	<i>10:35</i>			<i>.05 PCI</i>	<i>1-2x4 metal</i>	<i>Plastic tube of</i>
2								
3								
4								
5								
6								
7								
8								
9								
10								

TRANSFER NUMBER	ITEM NUMBER	TRANSFERS RELINQUISHED BY	TRANSFERS ACCEPTED BY	DATE	TIME	REMARKS
1	<i>1</i>	<i>Pak Aine</i>	<i>Dorita Jensen</i>	<i>10-18-95</i>	<i>10:40</i>	
2						
3						
4						

SAMPLER'S SIGNATURE *Pak Aine 10-18-95*



Job # 18146 Name Proton

COC \_\_\_\_\_

Number of Samples

Soils \_\_\_\_\_ Sludges \_\_\_\_\_ Liquids \_\_\_\_\_ Air (Tedlar Bags) \_\_\_\_\_

Filter Cakes \_\_\_\_\_ Stabilized Material I Slurry Solids \_\_\_\_\_ Slurries \_\_\_\_\_

Solvents \_\_\_\_\_ Other (specify) \_\_\_\_\_

Turn Around Times

The turn around time requested 4 days Preliminary results due 10/23 Final results due 10/25

QA/QC (Check the appropriate box below.)

- ☒ Standard Standard level of QA/QC supplied by the lab, this corresponds roughly to QA2 without the blanks.
- ☐ QA1 Sample documentation. Instrument calibration or performance check, detection limits where applicable.
- ☐ QA2 QA1 + COC, holding times, method blank, rinsate blank, & trip blank (extra cost).
- ☐ QA3 QA2 + performance check samples (one per matrix), & matrix spikes. (Significant extra cost)
- ☐ CLP Full CLP protocol. (Significant extra cost)

Physical Testing

- ☐ BTU (ASTM D240-76) ☐ pH (EPA 150.1 or 9045) ☐ Flashpoint (1010)
- ☐ Specific Gravity ☐ Physical Description ☐ Other \_\_\_\_\_

Inorganic Analyses

- ☐ Total Cyanide ☐ Amenable Cyanide ☐ Reactive Cyanide ☐ Total Sulfide
- ☐ Reactive Sulfide ☐ Total Chloride ☐ Total Sulfate ☐ Total Nitrate
- ☐ Total Phosphate ☐ Total RCRA metals (all by 6010, Hg by 7470) ☒ Priority Pollutant Metals
- ☐ Specific metals (see below)
- ☐ Aluminum ☐ Arsenic ☐ Barium ☐ Beryllium ☐ Cadmium ☐ Calcium
- ☐ Chromium ☐ Cobalt ☐ Copper ☐ Iron ☐ Lead ☐ Magnesium
- ☐ Manganese ☐ Mercury ☐ Molybdenum ☐ Nickel ☐ Potassium ☐ Thallium
- ☐ Selenium ☐ Silver ☐ Vanadium ☐ Zinc ☐ Other \_\_\_\_\_



Organic Analysis

- |  |   |   |   |
|--|---|---|---|
| <input type="checkbox"/> TPH IR (418.1)                      | <input type="checkbox"/> TPH Grav (418.2)                           | <input type="checkbox"/> TPH GC (8015M)               | <input type="checkbox"/> GRO (8015M)          |
| <input type="checkbox"/> DRO (8015M)                         | <input type="checkbox"/> CA LUFT                                    | <input type="checkbox"/> BTEX (8240)                  | <input type="checkbox"/> Oil & Grease (413.1) |
| <input checked="" type="checkbox"/> Volatile Organics (8240) | <input checked="" type="checkbox"/> Semivolatile Organics (8270)    | <input checked="" type="checkbox"/> Pesticides (8080) |   |
| <input checked="" type="checkbox"/> Herbicides               | <input type="checkbox"/> PAHs (HPLC)                                | <input checked="" type="checkbox"/> PCBs (8080)       | <input type="checkbox"/> Dioxins/Furans       |
| <input type="checkbox"/> TOC                                 | <input type="checkbox"/> TICs greater than 25% of internal standard |   |   |

☒ Other TAL LIST FOR REMEDIATION

☐ Silica gel clean-up required on extract prior to analysis

TCLP Extraction

- |  |  |  |
|--|--|--|
| <input type="checkbox"/> Volatile Organics (TCLP List) | <input type="checkbox"/> Semivolatiles (TCLP List) | <input type="checkbox"/> Metals (TCLP List)          |
| <input type="checkbox"/> Herbicides (TCLP List)        | <input type="checkbox"/> Pesticides (TCLP List)    | <input type="checkbox"/> PCBs (8080)                 |
| <input type="checkbox"/> Volatile Organics (PP List)   | <input type="checkbox"/> Semivolatiles (PP List)   | <input type="checkbox"/> Metals (PP List)            |
| <input type="checkbox"/> Herbicides (PP List)          | <input type="checkbox"/> Pesticides (PP List)      | <input type="checkbox"/> Specific metals (see below) |
- 
- |                                    |                                  |                                     |                                    |                                    |                                    |
|------------------------------------|----------------------------------|-------------------------------------|------------------------------------|------------------------------------|------------------------------------|
| <input type="checkbox"/> Aluminum  | <input type="checkbox"/> Arsenic | <input type="checkbox"/> Barium     | <input type="checkbox"/> Beryllium | <input type="checkbox"/> Cadmium   | <input type="checkbox"/> Calcium   |
| <input type="checkbox"/> Chromium  | <input type="checkbox"/> Cobalt  | <input type="checkbox"/> Copper     | <input type="checkbox"/> Iron      | <input type="checkbox"/> Lead      | <input type="checkbox"/> Magnesium |
| <input type="checkbox"/> Manganese | <input type="checkbox"/> Mercury | <input type="checkbox"/> Molybdenum | <input type="checkbox"/> Nickel    | <input type="checkbox"/> Potassium | <input type="checkbox"/> Thallium  |
| <input type="checkbox"/> Selenium  | <input type="checkbox"/> Silver  | <input type="checkbox"/> Vanadium   | <input type="checkbox"/> Zinc      | <input type="checkbox"/> Other     |                                    |

☐ Other \_\_\_\_\_

Other Considerations

- |   |   |
|---|---|
| <input type="checkbox"/> Report results on a dry weight basis | <input type="checkbox"/> Include chromatograms with results |
|---|---|
- 
- ☐ Specific detection limits required (check appropriate level below)
- |                                  |   |  |  |                                 |
|----------------------------------|---|--|--|---------------------------------|
| <input type="checkbox"/> >10 ppm | <input checked="" type="checkbox"/> 10 ppm - 1 ppm<br><small>METALS</small> | <input checked="" type="checkbox"/> 1 ppm - 100 ppb<br><small>SEMI-VOLATILES</small> | <input checked="" type="checkbox"/> 100 ppb - 1 ppb<br><small>ORGANICS</small> | <input type="checkbox"/> <1 ppb |
|----------------------------------|---|--|--|---------------------------------|
- 
- ☐ Anticipated contaminant levels (check appropriate level below)
- |                                     |  |                                  |   |  |                                 |
|-------------------------------------|--|----------------------------------|---|--|---------------------------------|
| <input type="checkbox"/> 10,000 ppm | <input checked="" type="checkbox"/> 1,000 ppm<br><small>METALS</small> | <input type="checkbox"/> 100 ppm | <input checked="" type="checkbox"/> 10 ppm<br><small>SEMI-VOLATILES</small> | <input checked="" type="checkbox"/> 1 ppm<br><small>ORGANICS</small> | <input type="checkbox"/> <1 ppm |
|-------------------------------------|--|----------------------------------|---|--|---------------------------------|

Approvals

Approved by: 

Date: 10/18/97

**APPENDIX D**

**WASTE CELL VOLUME CALCULATIONS**

AIR SPACE VOLUME CALCULATION OF WASTE UNIT 9  
 CAMU  
 PROTECO, PENUELAS, PUERTO RICO  
 OHM PROJECT NO. 18146

ELEVATION (ft msl)	THICKNESS (ft)	DEPTH (ft)	AREA (SF)	AVERAGE AREA (SF)	VOLUME (CF)	CUMUL. VOLUME (CF)
320	2	0	2032			
318	2	2	7728	4880	9760	9760
316	2	4	14020	10874	21748	31508
314	2	6	17589	15805	31609	63117
312	2	8	20217	18903	37806	100923
310	2	10	23065	21641	43282	144205
308	2	12	33859	28462	56924	201129
306	2	14	22638	28249	56497	257626
304	2	16	19588	21113	42226	299852
302	2	18	16689	18139	36277	336129
300	2	20	13942	15316	30631	366760
298	2	22	11346	12644	25288	392048
296	2	24	1045	6196	12391	404439

1 foot thick sand layer on bottom of cell	-12644
1 foot thick layer of clean soil on top of waste unit (approximate)	-33900

<u>Air space available for treated waste</u>	<u>357895</u>
--	---------------



Page 1 of     

Proj. No. 18146	Client PROTECO	Location PENUELAS, PR	Subject DESIGN OF W. U. #9
Preparer's Initials JKO	Date 12/7/95	Reviewer's Initials	Date
Approver's Initials		Date	

DETERMINE AND DESIGN WASTE UNIT  
9 TO CONTAIN TREATED WASTE FROM  
WASTE UNITS 4, 7, AND 9.

GIVEN:

ESTIMATED WASTE VOLUME

<u>UNIT</u>	<u>VOLUME (ft<sup>3</sup>)</u>
#4	40,000
#7	71,500
#9	143,000
TOTAL	254,500

SOLUTION:

ASSUME WASTE VOLUME WILL INCREASE  
BY 15% FROM STABILIZATION

$$V_{\text{waste II}} = V_{\text{waste I}} \times 15\%$$

$$V_{\text{waste II}} = 254,500 \text{ ft}^3 \times 0.15$$

$$V_{\text{waste I}} = 38,175 \text{ ft}^3$$

$$V_{\text{waste T}} = \sum V_{\text{waste I-II}} = 292,675 \text{ ft}^3$$

Page 2 of     

Proj. No. <u>18146</u>	Client <u>PROTECO</u>	Location <u>PENUELAS, PR</u>	Subject <u>DESIGN OF WUG</u>
Preparer's Initials <u>JKO</u>	Date <u>12/7/95</u>	Reviewer's Initials <u>    </u>	Date <u>    </u>
Approver's Initials <u>    </u>	Date <u>    </u>	Approver's Initials <u>    </u>	Date <u>    </u>

THE SURFACE OF THE LANDFILL IS APPROXIMATELY 33,000  $\text{ft}^2$  SEE ATTACHED FIGURE. A 1 ft THICK LAYER IS DESIRED ABOVE ALL THE WASTE TO ACHIEVE THE SUBBASE GRADES AS SHOWN IN SHEET C-7. THIS LAYER WILL BE CLEAN SOIL

$$V_{cs} = 33,000 \text{ ft}^2 \times 1 \text{ ft} = 33,000 \text{ ft}^3$$

THEREFORE TOTAL AIR SPACE VOLUME MUST BE NO LESS THAN

$$V_{AS} = V_{waste} + V_{cs} = 292,675 \text{ ft}^3 + 33,000 \text{ ft}^3$$

$$\underline{\underline{V_{AS} = 325,675 \text{ ft}^3 = 12,062 \text{ yd}^3}}$$

**Sampling and Analysis Plan  
for  
CAMU Waste Units 4, 7, 9, and 15  
Proteccion Tecnica Ecologica, Inc.**

Submitted to:

**Proteccion Tecnica Ecologica, Inc.  
Carr. 385 KM 3.5  
Penuelas, PR 00624**

Submitted by:

**OHM Remediation Services Corp.  
5335 Triangle Parkway, Suite 450  
Norcross, GA 30092**

Project No. 18146

September 1996

## TABLE OF CONTENTS

---

1.0	INTRODUCTION .....	1-1
1.1	Site Background .....	1-1
1.2	Project Task .....	1-1
1.3	Data Quality Objectives (DQOs) .....	1-1
2.0	PROJECT MANAGEMENT .....	2-1
2.1	Project Management Organization .....	2-1
3.0	SAMPLING AND ANALYSIS .....	3-1
3.1	Types of Sampling .....	3-1
3.2	Site Specific Sampling Events .....	3-1
3.2.1	Background Samples .....	3-1
3.2.2	Waste Unit 4, 7, and 9 Confirmation Samples .....	3-1
3.2.3	Treated Waste Sampling .....	3-2
3.3	Cross-Contamination Minimization .....	3-2
3.4	Equipment Decontamination .....	3-3
3.5	Sample Designation .....	3-3
3.6	Sample Preservation .....	3-4
3.7	Field QC Samples .....	3-4
3.8	Sample Log Book .....	3-5
3.9	Sample Labeling .....	3-7
3.10	Custody Seals .....	3-8
3.11	Chain-of-Custody (COC) Procedures .....	3-8
3.12	Shipment of Samples .....	3-10
4.0	DATA MANAGEMENT .....	4-1
4.1	Analytical Data Review .....	4-1
4.2	Project Data Review .....	4-3
4.3	Project Data Validation .....	4-3
4.4	Data Reporting .....	4-4
4.5	Data Storage and Archive .....	4-4
5.0	DATA ASSESSMENT PROCEDURES .....	5-1
5.1	Accuracy .....	5-1
5.2	Precision .....	5-2
5.3	Completeness .....	5-2
5.4	Criteria for Rejection of Outlying Measurements .....	5-3
5.5	Method Detection Limits and Practical Quantitation Limits .....	5-3
6.0	PERFORMANCE AND SYSTEM AUDITS .....	6-1
6.1	Field Performance Audits .....	6-1
6.2	Field System Audits .....	6-1
6.3	Laboratory Performance Audit .....	6-2
6.4	Laboratory System Audits .....	6-2
7.0	CORRECTIVE ACTION .....	7-1
7.1	Corrective Action Report .....	7-2
7.2	Quality Assurance Report .....	7-2

## TABLE OF CONTENTS - CONTINUED

---

### APPENDICES

Appendix A	Laboratory Deliverable Package
Appendix B	Table A-1 -Sampling Summary
	Table A-2 - Data Quality Objective Summary
Appendix C	Chain-of-Custody
	Class 9 Shipping Label
	Custody Seal
	Fed Ex Air Bill
	Directions for Completion of Airbill

## 1.0 INTRODUCTION

---

The ultimate accuracy of data generation begins with a sampling and measurement procedure which is well conceived and carefully implemented. A Sampling and Analysis Plan (SAP) is prepared as part of the Proteco Closure Plan Package and CAMU proposal to describe the methods that will be used to accomplish the chemical data quality control objectives to assure accurate, precise, representative, and comparable data in closing Waste Units 4, 7, 9, and 15. All sample collection procedures and protocols will follow applicable federal, state and local sample collection procedures and protocols.

This document will be reviewed, studied, understood, and implemented by the site project manager, QA officer, project chemist, field chemist and sample technicians. Any changes in the plan will be approved by the site project manager, QA officer, the project chemist and the Environmental Protection Agency's (EPA's) technical representative.

### 1.1 SITE BACKGROUND

Proteco's facility is located on the southern side of Puerto Rico approximately 2.5 miles southeast of Penuelas, 2 miles north of Tallaboa Bay, and 1.5 miles east of the Lower Tallaboa River Valley. Proteco owns and operates a waste disposal facility at this location and is closing Waste units 4, 7, 9, and 15. Refer to the Corrective Action Management Unit Proposal for additional information.

### 1.2 PROJECT TASK

Contaminated soil excavated from Units 4, 7 and 9 will be treated by chemical fixation and stabilization and placed into a geosynthetic and soil lined waste cell. Confirmation samples will be taken after removal of the contaminated material in each unit to demonstrate attainment of clean-closure. Also samples will be collected of the treated material to demonstrate attainment of the treatment goals.

### 1.3 DATA QUALITY OBJECTIVES (DQO)

All analysis will be performed at an off-site laboratory and all data will be approved by a Puerto Rico certified chemist. The laboratory data packages will include at a minimum the requirements for a standard level data package as outlined in Appendix A. These requirements ensure that the methodology and quality of the data are defensible and comparable. The data results will be definitive to provide the necessary information to meet the project requirements. The Project Data Quality Objectives are listed in Table A-2 in Appendix B.

Table A-2 Project DQOs lists the minimum practical quantitation limits (PQLs) for this project. These typical laboratory limits will provide analytical results below the Region III's Risk-Based Concentrations (RBC) levels if they are obtainable by the subcontract laboratory. The PQLs are highly dependent on the sample matrix interferences and may not be obtainable in all cases.

Data generated from the confirmation samples and the treated material samples will be used to make field decisions as listed in Table 1.1. The criteria by which these decisions will be made and the persons responsible for making the decisions are also listed.

**Table 1.1**  
**Actions Items**

<i>Project Task</i>	<i>Decision Maker</i>	<i>Criteria</i>	<i>Decision</i>
Confirmational Sampling	Proteco/EPA	If results are above RBC levels	Additional excavation may be required
		If results are below RBC levels	Area is ready for backfill
Treated Material	Proteco/EPA	If results are above the treatment criteria	Reprocess material
		If results are below the treatment criteria	Place the treated material into the cell

## 2.0 PROJECT MANAGEMENT

---

### 2.1 PROJECT MANAGEMENT ORGANIZATION

The project manager is the primary focal point for control of the project activities. The project manager will be supported by the QA Management team which will provide reviews, guidance, and technical advice on project execution issues. Members of this staff will be on an "as-needed" basis to assist in smooth project execution. The project manager will be supported by a supervisory, health and safety, and QA/QC staff to ensure that the project is safely executed in compliance with applicable laws, regulations, statutes, and industry codes.

Each specific project will be assigned to a project manager. Reporting to the project manager may be several individuals fulfilling the roles of deputy project manager, project chemist, health and safety officer, project engineer, QA/QC officers, and supervisors, as required. These individuals are responsible for fulfilling appropriate portions of the project QA program, in accordance with assignments made by the project manager. The project manager is responsible for satisfactory completion of the project QA program. Specific responsibilities may be assigned by the project manager to the deputy project manager and other members of the project staff.

The responsibilities of the key members for this project organization are:

#### *Project Manager*

The project manager is responsible for the overall direction of this project executed under his supervision. The project manager provides the managerial administrative skills to ensure that resource allocations, planning, execution, and reporting meet contract requirements. The project manager is ultimately accountable for all work activities undertaken on this project. The global quality-related responsibilities of the project manager can include, but are not limited to the following:

- Organization of the project staff and assignment of responsibilities
- Understanding of contract and scope of work for a specific project
- Communication to the project staff regarding client requirements and QA practices
- Day-to-day execution of the project

- Identification, documentation, and notification to the client and project staff of changes in the scope of work
- Procurement of subcontractor services as necessary
- Supervision of preparation and approval of project-specific procedures, work plans, and QA project plans
- Liaison for communications with the client and subcontractors Liaison between the project staff and other internal groups
- Serving as the "collection point" for project staff reporting of nonconformances and changes in project documents and activities
- Determination of the effect of nonconformances on the project and the appropriateness for reporting such items to the client, and providing appropriate documentation for reporting
- Notification of project and QA personnel of nonconformances and changes
- Notification of the project staff and, as appropriate, QA personnel of void project-related documents and information
- Determination that changes, revisions, and rework are subject to the same QC requirements as the original work
- Serve as final reviewer prior to release of project information to the client
- Approve and sign outgoing correspondence

Some of these responsibilities may be assigned by the project manager to the Site Supervisor, who will remain on site throughout the project.

*Project Chemist/QA/QC Officer*

The Project Chemist/QA/QC Officer is responsible for implementing the project plans and ensuring that the quality assurance and data quality objectives are being met for the project. He is also responsible for informing the Project Manager of any site-specific problems and for coordination of QA efforts with the contracted laboratory. His specific responsibilities include, but are not limited to:

- Directing the field chemists

- Tracking validation data and ensuring adherence to published guidelines
- Determining if the levels of QA are being met for the project
- Certifying the level of QA that has been achieved during the generation of analytical data
- Implementing QA/QC procedures
- Assuring the continuity of chain-of-custody evidence
- Initiating and overseeing all audit functions
- Compiling and submitting all QA Reports (QARs)
- Compiling, revising, updating, and submitting SAPs
- Reviewing subcontractor's QA Manuals and/or Laboratory Quality Management Plans (LQMPs)
- Ongoing QA/QC training of new and current personnel
- Stopping work if quality objectives are not being met.

#### *Field Chemists*

The field chemists will:

- Fill out sample tracking forms and related analytical and QC forms and logbooks
- Report data to the Project Chemist/QA/QC Officer/T&D Coordinator
- Carry out all sampling in accordance with approved procedures and methodologies as defined in the SAP
- Completing sampling logbooks, sampling forms, and chain-of-custody forms

For this project, the Project Chemist may also fulfill the role of the Field Chemist.

## 3.0 SAMPLING AND ANALYSIS

---

### 3.1 TYPES OF SAMPLING

In general, two basic types of sampling techniques are recognized : composite samples and grab samples.

#### **Composite Samples**

Composite samples are combinations of more than one subsample collected at various sampling locations and/or different points in time. Composites will be made up of equal volumes of grab samples; each grab sample will be collected in an identical manner.

Analyses of composites yield an average value and can, in certain instances, be used as an alternative to analyzing a number of individual grab samples and calculating an average value. It should be noted, however, that compositing of samples can mask problems by diluting isolated concentrations of some hazardous compounds to below detection limits.

#### **Grab Samples**

A grab sample is defined as a single sample representative of the specific location at a given point in time. The sample is collected all at once and at one particular point in the sample medium. The representativeness of such samples is defined by the nature of the materials being sampled. In general, as sources vary over time and distance, the representativeness of grab samples decreases.

### 3.2 SITE SPECIFIC SAMPLING EVENTS

#### **3.2.1 Background Samples**

Five background samples will be collected in areas close to the waste units but in areas not disturbed during site operations. These samples will be used to evaluate any natural occurring compounds or elements above the cleanup criteria. The required analysis for the background samples is summarized in Appendix B Table A-1.

#### **3.2.2 Waste Unit 4, 7, and 9 Confirmation Samples**

Each waste unit will be sampled after excavation of the contaminated material. One composite sample will be taken for each 2500 sf. of excavated area. The composite sample will be made from five random samples from each 2500 sf. area. This will yield one sample point for each 500 sf. excavation base. Volatile samples will not be composited but one grab will be chosen for the volatile sample in each sample area. One grab sample will be collected from each excavation wall and composited into one sample for non-volatile analysis. One volatile sample will be collected from each wall. These samples will not be composited but

analyzed separately. The required analysis for the confirmation samples is summarized in Appendix B Table A-1.

### 3.2.3 Treated Waste Sampling

One sample will be collected for each 500 cubic yards of treated material with a minimum of one sample daily. The treated material will be stockpiled into each sample batch. If the material meets the analytical requirements it will be placed into the lined waste cell. If the material does not meet the requirements it will be reprocessed and resampled. The required analysis for the treated samples is summarized in Appendix B Table A-1.

## 3.3 CROSS-CONTAMINATION MINIMIZATION

Cross-contamination is the introduction of contaminants into the sample through the sampling and/or sampling handling procedures. It can cause an otherwise representative sample to become non-representative. The most important means of minimizing cross-contamination are as follows:

- Sampling expendables, i.e., sample gloves, pipettes, string, dip jars, etc., must not be reused. Used expendables should be labeled so they are not confused with non-contaminated trash.
- Minimum contact should be made between the sampler and sample medium. For example, a sampler should not walk across a contaminated area and then take a surface soil sample where he has just stepped.
- Sample collection activities should proceed progressively from the least contaminated area to the most contaminated area.
- Sampling equipment should be constructed of Teflon, stainless steel, or glass that has been properly precleaned for collecting samples. Equipment constructed of plastic or PVC should not be used to collect samples for trace organic analyses.
- Any tools that could contaminate samples are prohibited in the sample handling and preparation area. These activities and the possible contaminants include:

Activity	Possible Contaminants
Smoking	PAHs
Spraying for insects	Pesticides, oils, solvents
Spraying for weeds	Herbicides, oils, solvents
Refueling	BTEX, hydrocarbons
Painting and paint stripping	Solvents

### 3.4 EQUIPMENT DECONTAMINATION

The following steps will be used to decontaminate the bacon bomb only. All other sampling equipment will be disposable (1-time use) and no decontamination will be required.

1. Clean with tap water and phosphate free laboratory detergent (Liquinox), using a brush to remove particulate matter and surface material.
2. Rinse thoroughly with tap water.
3. Rinse thoroughly with deionized water.
4. Rinse twice with pesticide grade isopropanol.
5. Rinse thoroughly with organic free water and allow to air dry as long as possible.
6. If organic free water is not available, allow equipment to air dry as long as possible. Do not rinse with distilled or deionized water.
7. Wrap with aluminum foil if appropriate, to prevent contamination if equipment is to be stored or transported.

Decontamination fluids will be collected, containerized and disposed of properly.

### 3.5 SAMPLE DESIGNATION

Each sample collected on-site will be provided with a sample designation and sample number. The designation will serve to identify the site, location and specific sample number. The sample will be numbered consecutively, starting with the first sample type.

The sample designation format will be as follows:

P-YY-NNN

Where:

P = Proteco

YY = Sample Task

CS = Confirmation Sample

TS = Treated Sample

DS = Disposal Sample

NNN = Sequential number starting at 001

If the sample is a field QC sample, except duplicates, add the appropriate designations listed below to the end of the sample number.

- TB = Trip Blank
- RB = Equipment Rinsate Blank

If the sample is a duplicate, "D" will be added to the end of the sample number.

### 3.6 SAMPLE PRESERVATION

The soil samples will be cooled to 4° C after collection. Water QC samples will required Nitric to pH less than 2 for the metal parameters. Volatile water samples can increase the hold time by 7 days with the addition of HCl to a pH of less than 2.

### 3.7 FIELD QC SAMPLES

The off-site laboratory will provide in-house QC results with the final laboratory report. The QC frequency and control limits for the off-site laboratory will be as specified in the SW-846 procedures.

The project chemist will collect additional sample amounts (liquid matrix only) for matrix spike and matrix spike duplicate analysis. Solid/sludge matrix samples will not require additional volumes for matrix spike and matrix spike duplicates. Samples that are designated for matrix spike and matrix spike duplicate analyses will be listed on the chain-of-custody form.

Field QC samples will include equipment rinsate blanks, field duplicates, and trip blank samples. These samples will be collected at the following frequencies and analyzed for the parameters listed in Appendix B, Table A-1.

- Equipment Rinsate Blank – Equipment rinsate blanks are the final analyte-free water rinse from equipment cleaning collected during a sampling event. One equipment rinsate blank will be collected for each ten samples during this project.
- Field Duplicate – Duplicates for soil samples are collected, homogenized, and split. All samples except volatiles are homogenized and split. Volatiles are not mixed, but select segments of soil or debris are taken and placed in 4-ounce glass jars.
- Trip Blank - Trip blanks are defined as samples which originate from analyte-free water taken from the laboratory to the sampling site and returned to the laboratory with the volatile samples. One trip blank should accompany each cooler containing volatiles, stored at the laboratory with the samples, and analyzed by the laboratory. Trip blanks are only analyzed for volatile organic compounds.

### 3.8 SAMPLE LOG BOOK

It is necessary for the sampling crew to maintain daily field notes in permanently bound notebooks. Items that must be included are sampling protocol, any changes to the procedures, meetings, instructions, safety precautions, personnel protection, and activities pertaining to the samples. The person taking notes must be knowledgeable enough about these activities to know which details are important.

Repetition of information recorded in other permanent logs should be avoided, but enough should be recorded to present a clear and accurate picture of technical activities. At a later date, should a question arise concerning a specific event or a procedure used, it will be answered from these notes. Some items that would be considered noteworthy are as follows:

- Termination of a sample point or parameter and reasons
- Unusual appearance or odor of a sample
- Measurements, volume, temperature, and weather conditions
- Additional samples and reasons for obtaining them
- Levels of protection used (with justification)

- Meetings and telephone conversations held with clients, regulatory agencies, citizens, project manager, or supervisor.
- Details concerning any samples split with another party

These notes must be dated and signed (each page) for validity in a court of law. All log book entries will be made with indelible ink and legibly written. The language will be factual and objective. No erasures will be permitted. If an incorrect entry is made, the error will be crossed out with a single strike mark, initialed, and dated. When audits are performed, the auditor's remarks and decisions must also appear in these notes. These audits should be followed up by written report submitted by the auditor, including opinions and conclusions. A copy of this report should be placed in the project file and one copy kept in the sampling file for easy reference.

All samples should be logged in the logbooks. The following columns are standard for all projects:

- 1) DATE -- Date sample was obtained
- 2) SAMPLE NUMBER -- Consecutive series of numbers which are assigned to every sample.
- 3) LOCATION -- Description of area sampled
- 4) TIME -- Military time sampled
- 5) SAMPLERS -- Initials of persons obtaining sample (usually two, at least witnessing if not involved in actual sampling task)
- 6) DESCRIPTION OF SAMPLE -- Physical description of sample (e.g., clear, cloudy, odor)
- 7) WEIGHT OR VOLUME -- Size of sample (500-ml, 1-L, etc)
- 8) DATE RESULTS ARE DUE -- Date analytical results should be reviewed
- 9) LABORATORY -- Laboratory who performed analytical work
- 10) RESULTS -- Will vary according to project requirements; should be in consistent units (ppm, ppb, etc.,) when possible

- 11) CHAIN-OF-CUSTODY NUMBER-- For samples sent to laboratory or given to client
- 12) ADDITIONAL COMMENTS -- Space reserved for any other information concerning particular sample or special procedure or analysis.
- 13) PRESERVATIVES -- Preservatives used or included by the lab
- 14) DATE SAMPLES SENT -- Date samples were sent to the lab
- 15) AIRBILL NUMBER

The following guidelines will be implemented for all log books:

- Each page will be signed, dated, and numbered;
- Blank pages will be identified as such;
- The time of each entry will be noted (24 hour clock);
- Logbook extensions (field sheets, purge records, etc.) will be recorded in the logbook; and
- Logbooks will be returned to the on-site coordinator upon completion, during periods of absence, and at the end of the investigation.

### 3.9 SAMPLE LABELING

Samples will be identified by a sample label attached to the sample container. All sample labels will be completed legibility with indelible ink. Each sample label will be covered with clear tape. Included on the label are the following information:

- 1) JOB NUMBER
- 2) DATE -- Month, day, year
- 3) TIME -- Military time
- 4) SAMPLE NUMBER
- 5) SAMPLE DESCRIPTION
- 6) TAKEN BY -- Sampler name
- 7) REQUIRED ANALYSIS
- 8) DESIGNATION BETWEEN GRAB AND COMPOSITE
- 9) PRESERVATIVES ADDED

The information described above should be printed neatly using an indelible, waterproof marker. After the sample is taken and the label is securely attached, the sample is logged into the sample log book or data base.

### 3.10 CUSTODY SEALS

Custody seals are narrow strips of adhesive tape of glass fiber used to demonstrate that no tampering has occurred. They will be used on shipment coolers and individual sample jars. The custody seals must be signed and dated by the sampler and placed from one side, across the top, and to the other side of the sample bottle or across the opening of the sample transport containers. A minimum of two signed custody seals per cooler is required; one on the front and one on the rear of the cooler both covered with clear tape. Seals on individual sample containers are also an additive check on sample integrity.

### 3.11 CHAIN-OF-CUSTODY (COC) PROCEDURES

Because of the evidentiary nature of samples collected throughout the project, the possession of samples must be traceable from the time the samples are collected until they are introduced as evidence in legal proceedings. To maintain and document sample possession, chain-of-custody procedures are followed as described below:

A sample is under your custody if:

- 1) It is in your actual possession, or
- 2) It is in your view, after being in your physical possession, or
- 3) It was in your physical possession and then you locked it up to prevent tampering, or
- 4) It is in a designated secure area.

An example of the COC has been provided in the Appendix C of this plan. The following information is required on the COC:

- 1) PROJECT NAME
- 2) PROJECT LOCATION -- City in which the project is located
- 3) JOB NUMBER

- 4) PROJECT CONTACT -- Employee responsible for overseeing the sampling operation. This person should be the individual to whom questions are to be directed or verbal results given (Project Manager, Site Supervisor, or Project Chemist)
- 5) PROJECT TELEPHONE NUMBER -- Telephone number of on-site office trailer or number where person responsible for samples can be contacted.
- 6) DATE -- Month, Day, Year
- 7) TIME -- Military time
- 8 ) SAMPLE IDENTIFICATION -- Sample number/location
- 9) BOTTLE SIZE -- 12 ounces, 8 ounces, 1 liter, etc.
- 10) ANALYSES REQUESTED
- 11) LABEL, TAG NO./ REMARKS
- 12) AIRBILL NO
- 13) LABORATORY -- Laboratory where samples are to be sent
- 14) PHONE -- Telephone number of laboratory
- 15) ATTN -- Contact for laboratory
- 16) RELINQUISHED BY -- Signature of sender (OHM)
- 17) DATE -- Date samples are sent
- 18) TURNAROUND TIME -- Turnaround times requested or date the results are required from the lab.

The COC needs to be sealed in a ziploc bag and taped in place on the underside of the top of the sample transport container (cooler).

### 3.12 SHIPMENT OF SAMPLES

Samples will be shipped overnight courier or hand delivered to the appropriate laboratory. No sample will be held on-site for more than 24 hours. Also, COCs should have been prepared accordingly and are organized according to sampling events.

The following instructions are for shipping samples with **unknown or limited** hazards. No changes or substitutions to these instructions are allowed – no matter how insignificant they may seem. Failure to follow these instructions may result in shipment refusals and/or delays.

- 1) Samples must be shipped in "strong outer packaging". A plastic cooler is acceptable.
- 2) Both the shipper's and receiver's addresses must be on the container.
- 3) The following shipping name must be printed on the container:

OTHER REGULATED SUBSTANCES,  
ID # 8027

- 4) A Class 9 hazardous material shipping label must appear on the top of the box. Included in Appendix C is an example of a shipping label which also includes places for the shipper's and receiver's addresses.
- 5) Inner packages cannot exceed 1 gallon each, and the entire shipment (cooler, samples, and absorbent) cannot exceed 66 lbs.
- 6) Coolers must be packed with absorbent such as vermiculite.
- 7) Each sample container must be placed in a ziploc bag and sealed.
- 8) The materials must be shipped using a Hazardous Materials Airbill. The Telephone Number for a Point of Contact should be on the Airbill.
- 9) Refer to Appendix C for details on how to fill out the Hazardous Materials Airbill.
- 10) If the samples are of a known hazard, the samples must be shipped accordingly.

## 4.0 DATA MANAGEMENT

---

Data management is the system by which data is reduced, reviewed, validated, reported, distributed, and finally archived. The criteria in this system are designed to meet the project objectives.

### 4.1 ANALYTICAL DATA REVIEW

All data generated within the laboratory will be checked for accuracy, precision, and completeness. The data review process consists of data generation, reduction, and three levels of review.

The analyst who generates the raw data has the prime responsibility for the correctness and completeness of the data. All data generated and reduced follows protocols specified in the laboratory (SOP). Each analyst reviews the quality of his work based on an established set of guidelines. The guidelines are:

- Sample preparation information is correct and complete
- Analysis information is correct and complete
- The appropriate SOPs have been followed
- Analytical results are correct and complete
- QC samples are within established control limits
- Blanks are within appropriate QC limits
- Special sample preparation and analytical have been met
- Documentation is complete

The next level of review is performed by the section supervisor or data review specialist. The review is structured to ensure that:

- Calibration data are scientifically sound, appropriate to method, and completely documented.
- QC samples are within established limits.
- Reporting units are consistent with the method and the matrix.
- Quantitative results are correct.
- Data results are consistent with information on the COC.
- Documentation is complete.

- The data is ready for incorporation into a final report
- The data package is complete and ready for data archive.

This second level of review is structured to ensure all calibration data and QC sample results are reviewed and all of the analytical results from 10 percent of the samples are checked back to the bench sheet. If no problems are found with the data package, the review is complete. If problems exist, an additional 10 percent is reviewed, the process continues until no errors are found or the package has been reviewed in its entirety.

The final level of review by the laboratory comes from the program administrator or laboratory QA Officer. He/she reviews the report to ensure that the data meets the overall objectives of the project.

Once the data has been validated, it is ready for report production. The report will contain:

- Description of sample types
- Tests performed, problems encountered during testing
- Dates sampled
- Date received
- Date extracted
- Analytical results
- Reportable limit
- QC information: percent recovery, relative percent difference, control limits, blanks analyses, matrix spikes, and other additional special QC information
- Qualifiers for data falling outside of QC limits
- Methodology
- Name of the analyst
- Signature of laboratory representative

- Dual column confirmation results
- Calibrations
- Instrument performance checks

The report from the laboratory will also include a copy of the original COC for the samples analyzed.

## 4.2 PROJECT DATA REVIEW

The field chemist is responsible for initial review of the data from the laboratory. This review includes:

- Verifying that all requested data are reported
- Verifying that samples are analyzed according to SW-846 procedures, when applicable
- Verifying that holding times are not exceeded
- Verifying that matrix spike, matrix spike duplicate, and surrogate recoveries fall within the laboratory's acceptable criteria
- Reviewing blank data for gross contamination
- Reviewing field quality control results for gross inconsistencies

The assigned chemist is then responsible for informing the Project Manager and Project QA/QC Officer of any laboratory and/or sampling deficiencies or issues. These issues and subsequent decisions will be documented on a weekly report to the Project QA/QC Officer and Project Manager.

## 4.3 PROJECT DATA VALIDATION

Data validation is an extensive review of the data for technical and legal validity. This procedure will be performed only by qualified and experienced personnel. This procedure is expensive and should be considered on projects with a high probability for litigation.

The guidelines to be used for data validation will be the USEPA National Functional Guidelines for Data Validation of Organics and Inorganics.

#### 4.4 DATA REPORTING

Generally, preliminary data is faxed to the project manager. This data may or may not have undergone the full laboratory review process and may contain errors and discrepancies. These reports should be stamped with the words "Preliminary Data—Has Not Undergone Full Lab Review". Upon receipt of the hard copy final report on-site, the field chemist and the project manager will review the data. Any discrepancies will be brought to the Project QA/QC Officer's attention, who will contact the laboratory regarding the issues. When QA issues have been satisfactorily settled and data validation has been completed, the project manager will release the data.

#### 4.5 DATA STORAGE AND ARCHIVE

After Proteco has completed its work for the project, all documents generated will be assembled in the project file. Individuals may retain clean (no handwritten comments) copies of documents for their personal files but only after personally verifying that the original or similar copy is in the project file. The project manager/supervisor is responsible for ensuring the collection, assembly, and inventory of all documents relative to the project at the time the objectives are met. The file then becomes accountable. Any records leaving the file must be signed out.

When a contractor has completed the project objectives, all file documents are reviewed and submitted to the general file. The project file contains the following document classes:

- A. Project logbooks
- B. Drum logs and other forms
- C. Sample identification documents
- D. Chain-of-custody records
- E. Analytical logbooks, laboratory data, calculations, graphs, etc.
- F. Correspondence
  - Intra-office
  - Client
  - Regulating agencies
  - Record of confidential material
- G. Report notes, calculations, drafts
- H. References, literature
- I. Sample (on-hand) inventory
- J. Check-out logs
- K. Litigation documents
- L. Miscellaneous – photographs, maps, drawings, etc.

Once deposited in the file, documents must be checked out.

The final report is usually generated by use of computer. A back-up copy of the report on diskette is filed along with the project file. The original report remains in the hard drive of the computer until such a time is required to download it on a diskette. This diskette is also archived.

All information under the corresponding project number is maintained in the archive system for eight years. All archives are accessed by the archives file master list which is maintained in a separate location from the archives.

## 5.0 DATA ASSESSMENT PROCEDURES

---

Reliability in analytical determination is maintained through strict adherence to quality control procedures. Procedures are designed to control both the accuracy and precision of analytical results.

Control charts will be prepared using an estimate of the spike recovery obtained from the literature or determined by repeated analyses run in the laboratory. Each time the analyst runs a method spike, the results are entered on the control table. If a standard addition technique is used, a plot of instrument response versus added analyte concentration is made in order to determine analyte concentration in the original sample. These are further explained in the laboratory's QAM.

Replicate analyses will be performed on at least 10 percent of the samples processed by the laboratory. A record of the precision of most analyses is kept by calculating and plotting the industrial statistic I (which is equivalent to the coefficient of variation). Blanks are also run with each batch of samples or individual sample analyzed regardless of the level of certification of the data.

The purpose of spikes, blanks, and replicates is to provide a sound scientific basis from which the degree of certification of the resultant data can be objectively concluded. These are not management decisions, but follow naturally from the results of the above QC procedures.

### 5.1 ACCURACY

Data accuracy is a reflection of the efficiency of the analytical procedure. It is determined by use of spiked samples and standard reference materials or laboratory control samples performed at the rate of one set every 20 samples. A control chart is generated by the laboratory using historical data where warning and control limits are established to assess data accuracy.

The accuracy criteria is determined by calculating the standard deviation of seven or more percent recovery values and setting the upper and lower control limits using the following equations:

$$\text{Upper control limit} = p + 3SD$$

$$\text{Lower control limit} = p - 3SD$$

Where:

p = Average percent recovery

SD = Standard deviation

After the standard deviation, for the seven or more samples has been calculated, the accuracy control limits will be used to determine if the analysis is out of control. This is done by checking the results against the control limits. If any values are above the upper control limit or below the lower control limit, all sample results after the last qualifying accuracy sample must be repeated or discarded. If seven consecutive values fall below the lower control limit, new limits must be calculated using the new accuracy check values. If the values fall between the upper and lower limits, then conditions are reported as "within limits."

Recovery control is necessary to determine if the sample matrix is interfering with the constituent being analyzed. A minimum of 5 percent of samples will be recovery check samples (matrix spikes). Samples involving different types of matrices must have at least one recovery check for each type. Since the matrices for this project are not common (soil, water, sediments), a matrix spike should be performed on at least one of the samples from the site.

## 5.2 PRECISION

Duplicate and replicate samples analyzed by the laboratory assess the precision of the sampling effort. Precision is based upon the results of the relative percent differences as calculated from the percent recoveries of the matrix spike and duplicate samples. Present practice is to include MS and MSD samples on a per batch basis or a minimum frequency of 5 percent. Duplicate results are compared and the relative percent difference (RPD) is then determined. Control limits on duplicate/replicate RPDs for this project is set at 0 to 50 percent to provide interim guidelines due to the complexity of the matrix.

## 5.3 COMPLETENESS

The field supervisor is responsible for ensuring that all field instrumentation and equipment are functioning properly and calibrated according to set procedures, and that all data are recorded accurately and legibly. In addition, the field supervisor must ensure all sites are sampled for all the specified analyses, that sufficient sample volume has been provided to complete those analyses, and that all of the QA samples have been included with each sample set. The goal for completeness for each sample set shipped to the laboratory is 100 percent. The minimum acceptable completeness limit is 90 percent.

Completeness is expressed as the percentage of the amount of valid data obtained to the amount of data expected. For a set of data to be considered complete, it must include all QC data verifying its accuracy and precision. If samples analyzed do not meet all QC requirements in terms of accuracy and precision for any specific parameter, the sample preparation and analysis will be repeated pending adequate volume.

#### **5.4 CRITERIA FOR REJECTION OF OUTLYING MEASUREMENTS**

Criteria for rejection of outlying measurements should be based on those cited in the SW-846 methods. However, since the limits listed in these methods are based on "clean water" samples, it is anticipated that a broader range of control limits will be used for this project.

Another reference is the USEPA National Functional Guidelines for Data Validation of Organics and Inorganics.

#### **5.5 METHOD DETECTION LIMITS AND PRACTICAL QUANTITATION LIMITS**

Method detection limit requirements or Practical Quantitation limits (PQL) will be as specified in each of the SW-846 methods. Project required PQL are listed in Appendix B, Table A-2. It is anticipated that the clean confirmation sample should meet the PQL's listed. If matrix interferences are encountered, higher PQLs may be obtained.

## 6.0 PERFORMANCE AND SYSTEM AUDITS

---

Audit is defined as systematic check to determine the quality of operation of field and laboratory activities. It is comprised of the following:

- Performance audit
- System audits

These include a detailed review of each operating component of the network. Auditing will ultimately assist in determining if each element within a system is functioning appropriately per the QA program requirements.

### 6.1 FIELD PERFORMANCE AUDITS

Field performance audits are performed on an ongoing basis during the project as field data is generated, reduced, and analyzed. All numerical analyses, including manual calculations are documented. All records of numerical analysis are legible, of reproduction quality, and supporting to complete permit logical reconstruction by a qualified individual other than the originator.

Other indicators of the level of field performance are the analytical results of the blank, duplicate, and replicate samples. Each blank analysis is an indirect audit of effectiveness of measures taken in the field to ensure sample integrity. The results of the field duplicate and replicate analysis is an indirect audit of the ability of each field team to collect representative sample portions of each matrix type.

### 6.2 FIELD SYSTEM AUDITS

System audits of site activities are accomplished by an inspection of all field activities by the Project QA/QC Officer. This audit is composed of comparisons between current field practices and standard procedures. The following is a list of criteria to be used in the evaluation of field activities:

- Overall level of organization and professionalism
- All activities conducted in accordance with work plan
- All procedures and analyses conducted according to procedures outlined in this document
- Level of activity and sample documentation

- Working order of instruments and equipment
- Level of QC conducted by each field team
- Contingency plans in case of equipment failure or other event preventing the planned activity from proceeding
- Level of efficiency which each team conducts planned activities at the site
- Sample packaging and shipment

After the audit, any deficiencies are discussed with the field staff, and corrections are identified. If any of these deficiencies possibly affect the integrity of the samples being collected, the Project QA/QC Officer informs the field staff immediately, so corrections can be made. The field performance audit should be conducted at the start of the project, one before the end of the project, or as directed by the Project Manager.

### 6.3 LABORATORY PERFORMANCE AUDIT

The laboratory performance audit verifies the ability of the laboratory to correctly identify and quantitate compounds in blind check samples submitted by an auditing agency. During the course of the project, it may be necessary for the Project QA/QC Officer to send PE samples to the laboratory to evaluate specific parameters when problems or issues arise.

### 6.4 LABORATORY SYSTEM AUDITS

The laboratory system audit is a review of analytical laboratory operations to verify that the facility has the necessary equipment, staff, and procedures in place to generate acceptable data.

The lab system audit can also be used to determine that each element within an activity is functioning appropriately and within the guidelines of applicable methodology, approved procedures, and the site SAP. An on-site inspection is routinely performed by the laboratory's QA Manager and may also be performed by the Project QA/QC Officer when it is necessary to allay any issues on the project. Project-specific audit reports will be placed in the project files and laboratory audit reports will be kept by the laboratory for future reference.

## 7.0 CORRECTIVE ACTION

---

Corrective actions may be necessary as a result of the following QA activities:

- Field and laboratory performance audits
- Field and laboratory system audits
- Inter-laboratory comparison studies
- Calibration data fall out of specified limits
- Failure to adhere to the SAP
- Failure to adhere to standard operating procedures and methods
- Data completeness below required limits
- Control limits are exceeded for QC samples

If, during system and performance audits, deficiencies or problems are discovered, corrective action will be initiated immediately. The appropriate field and laboratory personnel will be notified immediately an investigative process will be implemented immediately to find solutions to these issues. The investigative process will consist, but is not limited to, the following:

- Determining when the problem occurred
- Determining which systems were affected by the problem
- Determining the cause of the problem
- Determining a corrective action to eliminate the problem
- Assigning the responsibility for implementing the corrective action
- Implementing the corrective action
- Evaluating the effectiveness of the corrective action
- Investigating alternative corrective actions if the original action was not sufficient in eliminating the problem
- Documenting that the corrective action has eliminated the problem

The Project QA/QC Officer has the authority to require that all site activities threatened by the problem be stopped or limited until the corrective action has been implemented and satisfactorily verified to eliminate the problem.

Corrective actions may include, but is not limited to:

- Modifications to procedures
- Recalibration of instruments
- Replacement of solvents, reagents, and/or standards
- Additional training of personnel
- Reassignment of personnel

## 7.1 CORRECTIVE ACTION REPORT

A Corrective Action Report (CAR) is necessary documentation of the investigative process. Depending on the issues, the CAR may be generated by the laboratory or the field personnel. Copies of the CAR will be given to the Project QA/QC Officer and Project Manager. A copy of the CAR will be placed in the project files for future reference.

The CAR should include, but is not limited to:

- A description of the problem, deficiency, or issue
- Proposed resolutions
- Resulting actions
- Effectiveness of the resolutions
- Personnel responsible for implementation of the corrective actions
- Personnel responsible for monitoring the effectiveness of the actions.

## 7.2 QUALITY ASSURANCE REPORT

The Project Manager, Project QA/QC Officer, and Field Chemist will converse on a regular basis to review possible and potential problem areas and to ensure that all QA/QC procedures are being carried out. It is important that all data abnormalities be investigated to ensure that they are not a result of operator or instrument deviation but are a true reflection of the methodology or task function. The project final report will contain a separate section that covers the data quality and validity. At a minimum, the following information will be included in the report:

- Assessment of measurement data precision, accuracy, and completeness
- System and performance audit results
- Significant QA problems and corrective actions implemented

- Copies of documentation such as memos, reports, etc.

The Project QA/QC Officer will be responsible for preparing this report weekly or daily, as well as monthly written QA reports to OHM QA management. Verbal reports will be made on a more frequent basis. All reports will be made available to the Project Manager and USACE . If no project audits were performed and no significant QA/QC problems occurred, a letter stating these facts will be submitted to the referenced parties in lieu of a QA Report.

**APPENDIX A**

**LABORATORY DELIVERABLE PACKAGE**

Method	Deliverable Requirement	Equivalent EPA Form	OHM Minimum Level	OHM Standard Level	OHM Maximum Level
Metals	Case Narrative		X	X	X
	Corrective Action Report		X	X	X
	Cross-reference of OHM Sample Numbers, Lab IDs, and analytical QC batches		X	X	X
	Chain-of-Custody Form, Cooler Receipt form		X	X	X
	Data Summary for Each Sample (See Note 1)	I-IN	X	X	X
	Blank Spike or Lab Control Sample (LCS) results (including concentration spiked, percent recovered, percent recovery acceptance limits)	VII-IN	X	X	X
	Matrix Spike (MS) Report (including concentration spiked, percent recovered, percent recovery acceptance limits)	V (PART 1)IN	X	X	X
	Post-digestion Spike Recovery for ICP	V (PART 2)IN	X	X	X
	Duplicate Sample Report		X	X	X
	Blank Results	III-IN	X	X	X
	Initial Calibration Data	III-IN		X	X
	Continuing Calibration Data	II (PART I)-IN		X	X
	ICP Interference Check Sample Report	II (PART I)-IN		X	X
	Standard Addition Results	IV-IN		X	X
	ICP Serial Dilution Results	VIII-IN			X
	Copies of Preparation Logs	IX-IN			X
	Copies of Analysis Run Logs	XIII-IN		X	X
	Copies of Standard Preparation Logs	XIV-IN			X
	Raw Data and Instrument Printouts				X
	Percent Moisture		X	X	X
	pH				X (Note 2)

## Notes:

1) Must include: OHM sample ID, Lab ID, date/time sampled, date received, extracted/analyzed, Practical Quantitation Limit, Method Detection Limit, Dilution Factor, comments, approval signature/date

2) For water samples only.

Method	Deliverable Requirement	Equivalent EPA Form	OHM Minimum Level	OHM Standard Level	OHM Maximum Level
Organics by GC or HPLC	Case Narrative		X	X	X
	Corrective Action Report		X	X	X
	Cross-reference of OHM Sample Numbers, Lab IDs, and analytical QC batches	IV	X	X	X
	Chain-of-Custody Form, Cooler Receipt form		X	X	X
	Data Summary for each blank and sample (See Note 1)	I	X	X	X
	Blank Spike or Lab Control Sample (LCS) results (including concentration spiked, percent recovered, percent recovery acceptance limits)		X	X	X
	Surrogate Recovery Report (including concentration spiked, percent recovered, and percent recovery acceptance limits)	II	X	X	X
	Matrix Spike/Matrix Spike Duplicate (MS/MSD) Report (including concentration spiked, percent recovered, percent recovery acceptance limits, relative percent difference (RPD), and RPD acceptance limits)	III	X	X	X
	Initial Calibration Data for each column (indicate which column was used for quantitation)	VI		X	X
	Continuing Calibration Data (indicate which column was used for quantitation)	VII		X	X
	Chromatograms for each sample (and reruns), confirmation runs, blank, spike, duplicate, and standards			X (Note 4)	X
	Raw Quantitation Report (area vs. retention time)				X
	Copies of Sample Preparation Bench Sheets			X	X
	Copies of Standard Preparation Logs				X
	Copies of Run Logs	VIII			X
	Percent Moisture		X	X	X

## Notes:

1) Must include: OHM sample ID, Lab ID, date/time sampled, date received, extracted/analyzed, Practical Quantitation Limit, Method Detection Limit, Dilution Factor, comments, approval signature/date.

4) For petroleum fuels analyses chromatograms for samples with positive results only.

Method	Deliverable Requirement	Equivalent EPA Form	OIM Minimum Level	OIM Standard Level	OIM Maximum Level
Inorganic Chemistry (Note 2)	Case Narrative		X	X	X
	Corrective Action Report		X	X	X
	Cross-reference of OIM sample numbers, Lab IDs, and analytical QC batches		X	X	X
	Chain-of-Custody Form, Cooler Receipt form		X	X	X
	Data Summary for each blank and sample (See Note 1)		X	X	X
	Blank Spike or Lab Control Sample (LCS) results (including concentration spiked, percent recovered, percent recovery acceptance limits)		X	X	X
	Matrix Spike/Matrix Spike Duplicate (MS/MSD) Report (including concentration spiked, percent recovered, percent recovery acceptance limits)		X	X	X
	Duplicate Sample Report		X	X	X
	Calibration Reports Initial and Continuing			X	X
	Copies of Sample Preparation logs				X
	Raw Data and Instrument Printouts				X
	Percent Moisture		X	X	X

## Notes:

- 1) Must include: OIM sample ID, Lab ID, date/time sampled, date received, extracted/analyzed, Practical Quantitation Limit, Method Detection Limit, Dilution Factor, comments, approval signature/date
- 2) Deliverables depend on method's QC

Method	Deliverable Requirement	Equivalent EPA Form	OHM Minimum Level	OHM Standard Level	OHM Maximum Level
Organics by GC/MS	Case Narrative		X	X	X
	Corrective Action Report		X	X	X
	Cross-reference of OHM sample numbers, Lab IDs, and analytical QC batches	IV		X	X
	Chain-of-Custody Form, Cooler Receipt Form		X	X	X
	Data Summary for each blank and sample (See Note 1)	I	X	X	X
	Tentatively Identified Compounds (TICs) for each sample (ten peaks)	I, TIC		X	X
	Blank Spike or Lab Control Sample (LCS) results (including concentration spiked, percent recovered, percent recovery acceptance limits)		X	X	X
	Surrogate Recovery Report (including concentration spiked, percent recovered, and percent recovery acceptance limits)	II	X	X	X
	Matrix Spike/Matrix Spike Duplicate (MS/MSD) Report (including concentration spiked, percent recovered, percent recovery acceptance limits, relative percent difference (RPD), and RPD acceptance limits)	III	X	X	X
	Instrument Performance Check (Tuning) Report	V		X	X
	Initial Calibration Data (including acceptance limits)	VI		X	X
	Continuing Calibration Data (including acceptance limits)	VII		X	X
	Internal Standard Areas and Retention Times Reports (including acceptance limits and out-of-control flags)	VIII		X	X
	Reconstructed Ion Chromatogram for each sample and rerun, blank, spike, duplicate, and standard				X
	Raw Quantitation Report				X
	Raw and background subtracted mass spectra for each target analyte found				X
	Mass spectra of TICs with library spectra of 5 best-fit matches				X
	Copies of Sample Preparation Bench Sheets			X	X
	Copies of Standard Preparation Logs				X
	Copies of Run Logs				X
	Percent Moisture		X	X	X
	pH				X (Note 3)

## **APPENDIX B**

**TABLE A-1 - SAMPLING SUMMARY**

**TABLE A-2 - DATA QUALITY OBJECTIVE  
SUMMARY**

T A-1  
PROTECO CAMU WASTE UNITS , 9 AND 15 SAMPLING SUMMARY

Sample Type	Matrix	Sampling Frequency	Approx No of Samples	Sampling Method	Sampling Equipment	Sample Containers	Preservatives	TAT	QC Level	Required Analysis	Analytical Method	Holding Time
Background Samples	Soil	Once	5	Grabs	SS auger SS Bowl SS spoon	(1) 8 oz. and (1) 4 oz.glass with teflon-lined lid	Cool 4 C	7 days, 21 days for final report	Defentive OHM Std level	Volatiles Semi-volatiles Pesticides/PCBs PP Metals	8260, 8270 8081 6010A, 7471	14 days VOAs 7 days to extract, 40 days to analyze 6 months, Hg 28 days
Unit 4,7 and 9 Confirmation	Soil	one five point composite every 2500sf of the base and one composite of the side walls (volatiles not composited)	30 (39 for the volatile samples)	Composites	SS spoon SS bowl	(1) 8 oz. and (1) 4 oz.glass with teflon-lined lid	Cool 4 C	7 days, 21 days for final report	Defentive OHM Std level	Volatiles Semi-volatiles Pesticides/PCBs PP Metals	8260, 8270 8081 6010A, 7471	14 days VOAs 7 days to extract, 40 days to analyze 6 months, Hg 28 days
Unit 15 Disposal Analysis	Solid	once	1	Grab	SS spoon SS bowl	(1) 8 oz. and (1) 4 oz.glass with teflon-lined lid	Cool 4 C	7 days, 21 days for final report	Defentive OHM Std level	Volatiles Semi-volatiles Pesticides/PCBs PP Metals Reactive CN Reactive Sulfide pH Flash Point	8260, 8270 8081 6010A, 7471 Chapter 7.3 Chapter 7.3 9045 9095	14 days VOAs 7 days to extract, 40 days to analyze 6 months, Hg 28 days 28 days 28 days Imed. NA
Treated Material	Soil	one sample per 500cy of processed material	20	Grabs	SS spoon SS bowl	(1) 8 oz. glass with teflon-lined lid	Cool 4 C	7 days, 21 days for final report	Defentive OHM Std level	TCLP Extraction VOA Semi-VOA Pesticides Herbicides 8 RCRA Metals	1311 8260 8270 8081 8150 6010,7471	14 days VOAs Semi-VOAs 7 days to extract, 40 days to analyze Metals 6 m, Hg 28 days
QC Duplicates	Soil	10%	3 (4 volatiles)	Composites and Grabs	SS spoon SS bowl	(1) 8 oz. and (1) 4 oz.glass with teflon-lined lid	Cool 4 C	7 days, 21 days for final report	Defentive OHM Std level	Volatiles Semi-volatiles Pesticides/PCBs PP Metals	8260, 8270 8081 6010A, 7471	14 days VOAs 7 days to extract, 40 days to analyze 6 months, Hg 28 days

Notes:

- 1) Calendar days
- 2) USEPA SW-846 methods unless otherwise specified
- 3) Begins from the date of collection in the field.

T-1  
PROTECO CAMU WASTE UNITS 1, 9 AND 15 SAMPLING SUMMARY

Sample Type	Matrix	Sampling Frequency	Approx No of Samples	Sampling Method	Sampling Equipment	Sample Containers	Preservatives	TAT	QC Level	Required Analysis	Analytical Method	Holding Time
QC Rinsate Blanks	water	one per day	2	Grabs	NA	(2) 40 ml VOA with septa tops (2) 1 liter w/teflon lined tops (1) 500 ml w/teflon lined tops	Cool 4 C VOA, Semi-VOA and Pest/PCB pH<2 w/Nitric for metals	7 days, 21 days for final report	Defensive OHM Std level	Volatiles Semi-volatiles Pesticides/PCBs PP Metals	8260, 8270 8081 6010A, 7471	7 days VOAs 7 days to extract, 40 days to analyze 6 months, Hg 28 days
QC Trip Blank	water	one per shipment	2	supplied by contract laboratory	NA	(2) 40 ml VOA w/septa tops	Cool 4 C	7 days, 21 days for final report	Defensive OHM Std level	Volatiles	8260	7 days

Notes:

- 1) Calendar days
- 2) USEPA SW-846 methods unless otherwise specified
- 3) Begins from the date of collection in the field

**TABLE A-2**  
**PROTECO PROJECT QUALITY CONTROL OBJECTIVES**

Method No <sup>1</sup>	Analyte / Component	Project Action Limits		Minimum PQL		Accuracy Limits MS/MSD Recoveries		Precision Limits MS/MSD Deviation		Accuracy Limits LCS Recoveries		Precision Limits Field Dup Deviation		Completeness Limits	
		Water	Soil <sup>2</sup>	Water	Soil <sup>2</sup>	Water	Soil <sup>2</sup>	Water	Soil <sup>2</sup>	Water	Soil <sup>2</sup>	Water	Soil <sup>2</sup>	Water	Soil <sup>2</sup>
		mg/L	mg/Kg	mg/L	ug/Kg	%	%	%	%	%	%	RPD	RPD	%	%
<b>ORGANOCHLORINE PESTICIDES</b>															
8081	Aldrin	NS	0.34	0.0004	0.3	60-140	20-150	<30	<50	47-116	47-116	<50	<75	95	90
8081	Alpha BHC	NS	0.91	0.0003	0.5	60-141	20-151	<30	<50	81-125	81-125	<50	<75	95	90
8081	Beta BHC	NS	3.2	0.0006	1	60-142	20-152	<30	<50	51-123	51-123	<50	<75	95	90
8081	Delta BHC	NS	NS	0.0009	1.5	60-143	20-153	<30	<50	76-126	76-126	<50	<75	95	90
8081	Gamma BHC (Lindane)	NS	4.4	0.0004	1	60-144	20-154	<30	<50	73-120	73-120	<50	<75	95	90
8081	Chlordane	NS	NS	0.0014	2	60-145	20-155	<30	<50	45-119	45-119	<50	<75	95	90
8081	4,4'-DDD	NS	NS	0.0004	1	60-146	20-156	<30	<50	48-136	48-136	<50	<75	95	90
8081	4,4'-DDE	NS	17	0.0012	2	60-147	20-157	<30	<50	45-139	45-139	<50	<75	95	90
8081	4,4'-DDT	NS	17	0.0002	2	60-148	20-158	<30	<50	34-143	34-143	<50	<75	95	90
8081	Dieldrin	NS	0.36	0.0014	0.3	60-149	20-159	<30	<50	42-132	42-132	<50	<75	95	90
8081	Endosulfan I	NS	NS	0.0004	2	60-150	20-160	<30	<50	49-143	49-143	<50	<75	95	90
8081	Endosulfan II	NS	NS	0.0066	10	60-151	20-161	<30	<50	78-159	78-159	<50	<75	95	90
8081	Endosulfan Sulfate	NS	NS	0.0006	2	60-152	20-162	<30	<50	46-141	46-141	<50	<75	95	90
8081	Endrin	NS	610	0.0023	10	60-153	20-163	<30	<50	43-134	43-134	<50	<75	95	90
8081	Endrin Aldehyde	NS	NS	0.0003	2	60-154	20-164	<30	<50	75-150	75-150	<50	<75	95	90
8081	Heptachlor	NS	1.3	0.0083	1	60-155	20-165	<30	<50	45-128	45-128	<50	<75	95	90
8081	Heptachlor Epoxide	NS	0.63	0.002	0.5	60-156	20-166	<30	<50	53-134	53-134	<50	<75	95	90
8081	Methoxychlor	NS	10000	0.003	200	60-157	20-167	<30	<50	73-142	73-142	<50	<75	95	90
8081	Toxaphene	NS	5.2	0.001	2.5	60-158	20-168	<30	<50	41-126	41-126	<50	<75	95	90
<b>PCBs</b>															
		mg/L	mg/kg	mg/L	mg/Kg	%	%	%	%	%	%	RPD	RPD	%	%
8081	Arochlor-1016	NS	NS	0.25	1	40-140	40-150	<30	<50	50-114	50-114	<50	<75	95	90
8081	Arochlor-1221	NS	NS	0.25	1	40-140	40-150	<30	<50	15-178	15-178	<50	<75	95	90
8081	Arochlor-1232	NS	NS	0.25	1	40-140	40-150	<30	<50	10-215	10-215	<50	<75	95	90
8081	Arochlor-1242	NS	NS	0.25	1	40-140	40-150	<30	<50	39-150	39-150	<50	<75	95	90
8081	Arochlor-1248	NS	NS	0.25	1	40-140	40-150	<30	<50	38-158	38-158	<50	<75	95	90
8081	Arochlor-1254	NS	NS	0.25	1	40-140	40-150	<30	<50	29-131	29-131	<50	<75	95	90
8081	Arochlor-1260	NS	NS	0.25	1	40-140	40-150	<30	<50	8-127	8-127	<50	<75	95	90
<b>Volatiles</b>															
		mg/L	mg/Kg	mg/L	mg/Kg	%	%	%	%	%	%	RPD	RPD	%	%
8260	Acetone	NS	2.00E+05	1	5	43-165	43-165	<20	<30	60-140	20-150	<30	<50	95	90
8260	Benzene	NS	200	0.1	1	51-139	51-139	<20	<30	60-140	20-150	<30	<50	95	90
8260	Bromoform	NS	720	1	5	67-129	67-129	<20	<30	60-140	20-150	<30	<50	95	90

Notes:

1) SW-846 Methods unless otherwise noted

2) Includes Sediments, Waste, Solids

NS = Not Specified

NA = Not Applicable

**TABLE A-2**  
**PROTECO PROJECT QUALITY CONTROL OBJECTIVES**

Method No <sup>1</sup>	Analyte / Component	Project Action Limits		Minimum PQL		Accuracy Limits MS/MSD Recoveries		Precision Limits MS/MSD Deviation		Accuracy Limits LCS Recoveries		Precision Limits Field Dup Deviation		Completeness Limits	
		Water	Soil <sup>2</sup>	Water	Soil <sup>2</sup>	Water	Soil <sup>2</sup>	Water	Soil <sup>2</sup>	Water	Soil <sup>2</sup>	Water	Soil <sup>2</sup>	Water	Soil <sup>2</sup>
8260	Bromomethane	NS	2900	1	5	49-117	49-117	<20	<30	60-140	20-150	<30	<50	95	90
8260	2-Butanone	NS	1.00E+06	2	10	50-163	50-163	<20	<30	60-140	20-150	<30	<50	95	90
8260	Carbon Disulfide	NS	2.00E+05	1	5	76-119	76-119	<20	<30	60-140	20-150	<30	<50	95	90
8260	Carbon Tetrachloride	NS	44	1	5	67-125	67-125	<20	<30	60-140	20-150	<30	<50	95	90
8260	Chlorobenzene	NS	1.00E+06	1	5	69-140	69-140	<20	<30	60-140	20-150	<30	<50	95	90
8260	Chlorodibromomethane	NS	68	1	5	64-120	64-120	<20	<30	60-140	20-150	<30	<50	95	90
8260	Chloroethane	NS	8.00E+05	1	5	62-116	62-116	<20	<30	60-140	20-150	<30	<50	95	90
8260	2-Chloroethyl Vinyl Ether	NS	NS	1	5	10-305	10-305	<20	<30	60-140	20-150	<30	<50	95	90
8260	Chloroform	NS	940	1	5	65-129	65-129	<20	<30	60-140	20-150	<30	<50	95	90
8260	Chloromethane	NS	440	1	5	38-116	38-116	<20	<30	60-140	20-150	<30	<50	95	90
8260	1,1-Dichloroethane	NS	2.00E+05	1	5	62-141	62-141	<20	<30	60-140	20-150	<30	<50	95	90
8260	1,2-Dichloroethane	NS	63	1	5	68-135	68-135	<20	<30	60-140	20-150	<30	<50	95	90
8260	1,1-Dichloroethene	NS	20000	1	5	54-128	54-128	<20	<30	60-140	20-150	<30	<50	95	90
8260	Cis-1,2-Dichloroethene	NS	1800	1	5	70-131	70-131	<20	<30	60-140	20-150	<30	<50	95	90
8260	Trans-1,2-Dichloroethene	NS	1800	1	5	61-138	61-138	<20	<30	60-140	20-150	<30	<50	95	90
8260	1,2-Dichloropropane	NS	84	1	5	76-132	76-132	<20	<30	60-140	20-150	<30	<50	95	90
8260	Cis-1,3-Dichloropropene	NS	NS	1	5	70-122	70-122	<20	<30	60-140	20-150	<30	<50	95	90
8260	Trans-1,3-Dichloropropene	NS	NS	1	5	42-154	42-154	<20	<30	60-140	20-150	<30	<50	95	90
8260	Ethylbenzene	NS	1.00E+06	1	5	59-140	59-140	<20	<30	60-140	20-150	<30	<50	95	90
8260	2-Hexanone	NS	NS	5	20	47-165	47-165	<20	<30	60-140	20-150	<30	<50	95	90
8260	Methylene Chloride	NS	760	1	5	55-126	55-126	<20	<30	60-140	20-150	<30	<50	95	90
8260	4-Methyl-2-Pentanone	NS	2.00E+05	5	20	77-119	77-119	<20	<30	60-140	20-150	<30	<50	95	90
8260	Styrene	NS	4.00E+05	1	5	71-133	71-133	<20	<30	60-140	20-150	<30	<50	95	90
8260	1,1,2,2-Tetrachloroethane	NS	29	1	5	55-138	55-138	<20	<30	60-140	20-150	<30	<50	95	90
8260	Tetrachloroethylene	NS	110	1	5	67-131	67-131	<20	<30	60-140	20-150	<30	<50	95	90
8260	Toluene	NS	4.00E+05	1	5	31-137	31-137	<20	<30	60-140	20-150	<30	<50	95	90
8260	1,1,1-Trichloroethane	NS	72000	1	5	68-135	68-135	<20	<30	60-140	20-150	<30	<50	95	90
8260	1,1,2-Trichloroethane	NS	100	1	5	70-141	70-141	<20	<30	60-140	20-150	<30	<50	95	90
8260	Trichloroethylene	NS	520	1	5	67-137	67-137	<20	<30	60-140	20-150	<30	<50	95	90
8260	1,2,3-Trichloropropane	NS	NS	1	5	76-140	76-140	<20	<30	60-140	20-150	<30	<50	95	90
8260	Vinyl Acetate	NS	NS	10	50	82-114	82-114	<20	<30	60-140	20-150	<30	<50	95	90
8260	Vinyl Chloride	NS	3	0.5	1	31-121	31-121	<20	<30	60-140	20-150	<30	<50	95	90
8260	Nylenes, Total	NS	1.00E+06	3	15	68-133	68-133	<20	<30	60-140	20-150	<30	<50	95	90

Notes:

1) SW-846 Methods unless otherwise noted

2) Includes Sediments, Waste, Solids

NS = Not Specified

NA = Not Applicable

**TABLE A-2**  
**PROTECO PROJECT QUALITY CONTROL OBJECTIVES**

Method No <sup>1</sup>	Analyte / Component	Project Action Limits		Minimum PQL		Accuracy Limits MS/MSD Recoveries		Precision Limits MS/MSD Deviation		Accuracy Limits LCS Recoveries		Precision Limits Field Dup Deviation		Completeness Limits	
		Water	Soil <sup>2</sup>	Water	Soil <sup>2</sup>	Water	Soil <sup>2</sup>	Water	Soil <sup>2</sup>	Water	Soil <sup>2</sup>	Water	Soil <sup>2</sup>	Water	Soil <sup>2</sup>
8260	1,4-Bromofluorobenzene	NA	NA	NA	NA	75-125	75-125	<20	<30	60-140	20-150	<30	<50	95	90
8260	1,2-Dichloroethane-d4	NA	NA	NA	NA	75-125	75-125	<20	<30	60-140	20-150	<30	<50	95	90
8260	Toluene-d8	NA	NA	NA	NA	75-125	75-125	<20	<30	60-140	20-150	<30	<50	95	90

SEMI-VOLATILES BY GC/MS		mg/L	mg/Kg	mg/L	mg/Kg	%	%	%	%	%	%	RPD	RPD	%	%
8270B	1,2,4-Trichlorobenzene	NS	20000	10	50	60-140	20-150	<30	<50	44-142	44-142	<50	<75	95	90
8270B	1,2-Dichlorobenzene	NS	2.00E+05	10	50	60-140	20-150	<30	<50	42-105	42-105	<50	<75	95	90
8270B	1,3-Dichlorobenzene	NS	2.00E+05	10	50	60-140	20-150	<30	<50	36-109	36-109	<50	<75	95	90
8270B	1,4-Dichlorobenzene	NS	240	10	50	60-140	20-150	<30	<50	30-107	30-107	<50	<75	95	90
8270B	2,4,5-Trichlorophenol	NS	2.00E+05	50	100	60-140	20-150	<30	<50	22-183	22-183	<50	<75	95	90
8270B	2,4,6-Trichlorophenol	NS	520	10	100	60-140	20-150	<30	<50	39-128	39-128	<50	<75	95	90
8270B	2,4-Dichlorophenol	NS	6100	10	100	60-140	20-150	<30	<50	46-123	46-123	<50	<75	95	90
8270B	2,4-Dimethylphenol	NS	41000	10	100	60-140	20-150	<30	<50	45-139	45-139	<50	<75	95	90
8270B	2,4-Dinitrophenol	NS	4100	50	100	60-140	20-150	<30	<50	30-151	30-151	<50	<75	95	90
8270B	2,4-Dinitrotoluene	NS	4100	50	100	60-140	20-150	<30	<50	39-139	39-139	<50	<75	95	90
8270B	2,6-Dinitrotoluene	NS	2000	50	100	60-140	20-150	<30	<50	51-125	51-125	<50	<75	95	90
8270B	2-Chloronaphthalene	NS	NS	10	50	60-140	20-150	<30	<50	60-118	60-118	<50	<75	95	90
8270B	2-Chlorophenol	NS	1000	50	100	60-140	20-150	<30	<50	41-121	41-121	<50	<75	95	90
8270B	2-Methylnaphthalene	NS	NS	10	50	60-140	20-150	<30	<50	41-123	41-123	<50	<75	95	90
8270B	2-Nitroaniline	NS	120	10	50	60-140	20-150	<30	<50	50-123	50-123	<50	<75	95	90
8270B	2-Nitrophenol	NS	NS	10	50	60-140	20-150	<30	<50	44-123	44-123	<50	<75	95	90
8270B	3,3'-Dichlorobenzidine	NS	13	1	5	60-140	20-150	<30	<50	29-183	29-183	<50	<75	95	90
8270B	3-Nitroaniline	NS	6100	50	100	60-140	20-150	<30	<50	51-118	51-118	<50	<75	95	90
8270B	4,6-Dinitro-2-methyl phenol	NS	NS	10	50	60-140	20-150	<30	<50	26-134	26-134	<50	<75	95	90
8270B	4-Bromophenyl phenyl ether	NS	1.00E+05	10	50	60-140	20-150	<30	<50	53-127	53-127	<50	<75	95	90
8270B	4-Chloroaniline	NS	NS	10	50	60-140	20-150	<30	<50	45-136	45-136	<50	<75	95	90
8270B	4-Chloro-3-methyl phenol	NS	NS	10	50	60-140	20-150	<30	<50	44-117	44-117	<50	<75	95	90
8270B	4-Chlorophenyl phenyl ether	NS	NS	10	50	60-140	20-150	<30	<50	51-132	51-132	<50	<75	95	90
8270B	4-Nitroaniline	NS	6100	50	100	60-140	20-150	<30	<50	40-143	40-143	<50	<75	95	90
8270B	4-Nitrophenol	NS	1.00E+05	50	100	60-140	20-150	<30	<50	11-131	11-131	<50	<75	95	90
8270B	Acenaphthalene	NS	NS	10	50	60-140	20-150	<30	<50	47-115	47-115	<50	<75	95	90
8270B	Acenaphthene	NS	NS	10	50	60-140	20-150	<30	<50	49-124	49-124	<50	<75	95	90
8270B	Anthracene	NS	6.00E+05	10	50	60-140	20-150	<30	<50	45-165	45-165	<50	<75	95	90
8270B	Benzo (a) anthracene	NS	7.8	1	5	60-140	20-150	<30	<50	51-133	51-133	<50	<75	95	90

Notes:

1) SW-846 Methods unless otherwise noted

2) Includes Sediments, Waste, Solids

NS = Not Specified

NA = Not Applicable

**TABLE A-2**  
**PROTECO PROJECT QUALITY CONTROL OBJECTIVES**

Method No <sup>1</sup>	Analyte / Component	Project Action Limits		Minimum PQL		Accuracy Limits MS/MSD Recoveries		Precision Limits MS/MSD Deviation		Accuracy Limits LCS Recoveries		Precision Limits Field Dup Deviation		Completeness Limits	
		Water	Soil <sup>2</sup>	Water	Soil <sup>2</sup>	Water	Soil <sup>2</sup>	Water	Soil <sup>2</sup>	Water	Soil <sup>2</sup>	Water	Soil <sup>2</sup>	Water	Soil <sup>2</sup>
8270B	Benzo (a) pyrene	NS	0.78	0.1	0.2	60-140	20-150	<30	<50	41-113	41-113	<50	<75	95	90
8270B	Benzo (b) fluoranthene	NS	7.8	1	5	60-140	20-150	<30	<50	37-119	37-119	<50	<75	95	90
8270B	Benzo (g,h,i) perylene	NS	NS	1	5	60-140	20-150	<30	<50	34-149	34-149	<50	<75	95	90
8270B	Benzo (k) fluoranthene	NS	78	5	10	60-140	20-150	<30	<50	37-123	37-123	<50	<75	95	90
8270B	Benzoic acid	NS	NS	10	50	60-140	20-150	<30	<50	1-162	1-162	<50	<75	95	90
8270B	Benzyl alcohol	NS	NS	10	50	60-140	20-150	<30	<50	35-121	35-121	<50	<75	95	90
8270B	Bis (2-chlorooctoxy) methane	NS	NS	10	50	60-140	20-150	<30	<50	49-104	49-104	<50	<75	95	90
8270B	Bis (2-chloroethyl) ether	NS	NS	10	50	60-140	20-150	<30	<50	44-106	44-106	<50	<75	95	90
8270B	Bis (2-chloroisopropyl) ether	NS	NS	10	50	60-140	20-150	<30	<50	36-166	36-166	<50	<75	95	90
8270B	Bis (2-ethylhexyl) phthalate	NS	NS	10	50	60-140	20-150	<30	<50	33-129	33-129	<50	<75	95	90
8270B	Butyl benzyl phthalate	NS	4.00E+05	10	50	60-140	20-150	<30	<50	26-123	26-123	<50	<75	95	90
8270B	Carbazole	NS	NS	10	50	60-140	20-150	<30	<50	34-132	34-132	<50	<75	95	90
8270B	Chrysene	NS	780	10	50	60-140	20-150	<30	<50	55-133	55-133	<50	<75	95	90
8270B	Di-n-butyl phthalate	NS	2.00E+05	10	50	60-140	20-150	<30	<50	34-126	34-126	<50	<75	95	90
8270B	Di-n-octyl phthalate	NS	41000	10	50	60-140	20-150	<30	<50	38-127	38-127	<50	<75	95	90
8270B	Dibenzo (a,h) anthracene	NS	0.78	0.1	0.2	60-140	20-150	<30	<50	50-118	50-118	<50	<75	95	90
8270B	Dibenzofuran	NS	NS	10	50	60-140	20-150	<30	<50	52-124	52-124	<50	<75	95	90
8270B	Diethyl phthalate	NS	1.00E+06	10	50	60-140	20-150	<30	<50	37-114	37-114	<50	<75	95	90
8270B	Dimethyl phthalate	NS	1.00E+06	10	50	60-140	20-150	<30	<50	6-186	6-186	<50	<75	95	90
8270B	Fluoranthene	NS	82000	10	50	60-140	20-150	<30	<50	47-111	47-111	<50	<75	95	90
8270B	Fluorene	NS	82000	10	50	60-140	20-150	<30	<50	48-139	48-139	<50	<75	95	90
8270B	Hexachlorobenzene	NS	3.6	0.1	1	60-140	20-150	<30	<50	46-133	46-133	<50	<75	95	90
8270B	Hexachlorobutadiene	NS	73	5	25	60-140	20-150	<30	<50	24-116	24-116	<50	<75	95	90
8270B	Hexachlorocyclopentadiene	NS	NS	10	50	60-140	20-150	<30	<50	41-115	41-115	<50	<75	95	90
8270B	Hexachloroethane	NS	410	10	50	60-140	20-150	<30	<50	7-153	7-153	<50	<75	95	90
8270B	Indeno (1,2,3-c,d) pyrene	NS	7.8	0.1	1	60-140	20-150	<30	<50	27-160	27-160	<50	<75	95	90
8270B	Isophorone	NS	6000	10	50	60-140	20-150	<30	<50	26-177	26-177	<50	<75	95	90
8270B	3-Methylphenol	NS	NS	10	50	60-140	20-150	<30	<50	41-144	41-144	<50	<75	95	90
8270B	N-Nitrosodi-n-propylamine	NS	0.82	0.05	0.1	60-140	20-150	<30	<50	37-117	37-117	<50	<75	95	90
8270B	N-Nitrosodiphenylamine	NS	1200	10	50	60-140	20-150	<30	<50	27-116	27-116	<50	<75	95	90
8270B	Naphthalene	NS	82000	10	50	60-140	20-150	<30	<50	50-120	50-120	<50	<75	95	90
8270B	Nitrobenzene	NS	1000	10	50	60-140	20-150	<30	<50	46-133	46-133	<50	<75	95	90
8270B	2-Methylphenol	NS	1.00E+05	10	50	60-140	20-150	<30	<50	25-125	25-125	<50	<75	95	90
8270B	p-Chloroaniline	NS	NS	10	50	60-140	20-150	<30	<50	56-107	56-107	<50	<75	95	90
8270B	4-Methylphenol	NS	10000	10	50	60-140	20-150	<30	<50	33-108	33-108	<50	<75	95	90

Notes:

1) SW-846 Methods unless otherwise noted

2) Includes Sediments, Waste, Solids

NS = Not Specified

NA = Not Applicable

**TABLE A-2**  
**PROTECO PROJECT QUALITY CONTROL OBJECTIVES**

Method No <sup>1</sup>	Analyte / Component	Project Action Limits		Minimum PQL		Accuracy Limits MS/MSD Recoveries		Precision Limits MS/MSD Deviation		Accuracy Limits LCS Recoveries		Precision Limits Field Dup Deviation		Completeness Limits	
		Water	Soil <sup>2</sup>	Water	Soil <sup>2</sup>	Water	Soil <sup>2</sup>	Water	Soil <sup>2</sup>	Water	Soil <sup>2</sup>	Water	Soil <sup>2</sup>	Water	Soil <sup>2</sup>
8270B	Pentachlorophenol	NS	48	1	20	60-140	20-150	<30	<50	28-136	28-136	<50	<75	95	90
8270B	Phenanthrene	NS	NS	10	50	60-140	20-150	<30	<50	54-120	54-120	<50	<75	95	90
8270B	Phenol	NS	1.00E+06	50	100	60-140	20-150	<30	<50	17-118	17-118	<50	<75	95	90
8270B	Pyrene	NS	6100	10	50	60-140	20-150	<30	<50	47-136	47-136	<50	<75	95	90
8270B	Nitrobenzene-d5	NA	NA	NA	NA	60-140	20-150	<30	<50	32-115	32-115	<50	<75	95	90
8270B	2-Fluorobiphenyl	NA	NA	NA	NA	60-140	20-150	<30	<50	43-116	43-116	<50	<75	95	90
8270B	Terphenyl-d14	NA	NA	NA	NA	60-140	20-150	<30	<50	42-126	42-126	<50	<75	95	90
8270B	Phenol-d5	NA	NA	NA	NA	60-140	20-150	<30	<50	13-108	13-108	<50	<75	95	90
8270B	2-Fluorophenol	NA	NA	NA	NA	60-140	20-150	<30	<50	25-95	25-95	<50	<75	95	90
8270B	2,4,6-Tribromophenol	NA	NA	NA	NA	60-140	20-150	<30	<50	22-134	22-134	<50	<75	95	90

METALS BY ICP		mg/l.	mg/kg	mg/l.	mg/kg	%	%	<30	<50	%	%	RPD	RPD	%	%
6010A	Aluminum	NS	NS	0.5	50	50-150	30-170	<30	<50	84-115	84-115	<50	<75	95	90
6010A	Antimony	NS	820	0.4	40	50-150	30-170	<30	<50	81-112	81-112	<50	<75	95	90
6010A	Arsenic	NS	610	0.6	60	50-150	30-170	<30	<50	79-115	79-115	<50	<75	95	90
6010A	Barium	NS	1.00E+05	0.02	2	50-150	30-170	<30	<50	85-112	85-112	<50	<75	95	90
6010A	Beryllium	NS	1.3	0.003	0.3	50-150	30-170	<30	<50	83-114	83-114	<50	<75	95	90
6010A	Cadmium	NS	1000	0.04	4	50-150	30-170	<30	<50	78-118	78-118	<50	<75	95	90
6010A	Calcium	NS	NS	0.1	10	50-150	30-170	<30	<50	84-114	84-114	<50	<75	95	90
6010A	Chromium	NS	NS	0.07	7	50-150	30-170	<30	<50	82-115	82-115	<50	<75	95	90
6010A	Cobalt	NS	1.00E+05	0.07	7	50-150	30-170	<30	<50	82-113	82-113	<50	<75	95	90
6010A	Copper	NS	82000	0.06	6	50-150	30-170	<30	<50	83-114	83-114	<50	<75	95	90
6010A	Iron	NS	6.00E+05	0.07	7	50-150	30-170	<30	<50	84-115	84-115	<50	<75	95	90
6010A	Lead	NS	NS	0.5	50	50-150	30-170	<30	<50	79-116	79-116	<50	<75	95	90
6010A	Magnesium	NS	NS	0.3	30	50-150	30-170	<30	<50	84-112	84-112	<50	<75	95	90
6010A	Manganese	NS	47000	0.02	2	50-150	30-170	<30	<50	84-114	84-114	<50	<75	95	90
6010A	Molybdenum	NS	NS	0.08	8	50-150	30-170	<30	<50	83-113	83-113	<50	<75	95	90
6010A	Nickel	NS	41000	0.15	15	50-150	30-170	<30	<50	82-112	82-112	<50	<75	95	90
6010A	Potassium	NS	NS	5	500	50-150	30-170	<30	<50	82-114	82-114	<50	<75	95	90
6010A	Selenium	NS	10000	0.8	80	50-150	30-170	<30	<50	68-121	68-121	<50	<75	95	90
6010A	Silver	NS	10000	0.07	7	50-150	30-170	<30	<50	75-123	75-123	<50	<75	95	90
6010A	Sodium	NS	NS	0.3	30	50-150	30-170	<30	<50	84-115	84-115	<50	<75	95	90
6010A	Thallium	NS	NS	0.4	40	50-150	30-170	<30	<50	80-112	80-112	<50	<75	95	90
6010A	Vanadium	NS	14000	0.08	8	50-150	30-170	<30	<50	82-112	82-112	<50	<75	95	90
6010A	Zinc	NS	6.00E+05	0.02	2	50-150	30-170	<30	<50	82-113	82-113	<50	<75	95	90

Notes:

1) SW-846 Methods unless otherwise noted

2) Includes Sediments, Waste, Solids

NS = Not Specified

NA = Not Applicable

**TABLE A-2**  
**PROTECO PROJECT QUALITY CONTROL OBJECTIVES**

		Project Action Limits		Minimum PQL		Accuracy Limits MS/MSD Recoveries		Precision Limits MS/MSD Deviation		Accuracy Limits LCS Recoveries		Precision Limits Field Dup Deviation		Completeness Limits	
Method No <sup>1</sup>	Analyte / Component	Water	Soil <sup>2</sup>	Water	Soil <sup>2</sup>	Water	Soil <sup>2</sup>	Water	Soil <sup>2</sup>	Water	Soil <sup>2</sup>	Water	Soil <sup>2</sup>	Water	Soil <sup>2</sup>
MERCURY BY COLD VAPOR		mg/L	mg/kg	mg/L	mg/kg	%	%	%	%	%	%	RPD	RPD	%	%
7470	Mercury	NS	NA	0.001	NA	50-150	NA	<30	NA	77-120	NA	<50	NA	95	NA
7471	Mercury	NA	610	NA	0.1	NA	30-170	NA	<50	NA	77-120	NA	<75	NA	90

Notes:

1) SW-846 Methods unless otherwise noted

2) Includes Sediments, Waste, Solids

NS = Not Specified

NA = Not Applicable

**Table A-2**  
**PROTECO TCLP PROJECT QUALITY CONTROL OBJECTIVES**

Method Number <sup>1</sup>	Analyte / Component	Project Action Limits		Minimum PQL		Accuracy Limits <sup>3</sup> MS/MSD recoveries		Precision Limits <sup>1</sup> MS/MSD deviation		Accuracy Limits <sup>3</sup> LCS recoveries		Precision Limits <sup>1</sup> Field Dup deviation		Completeness Limits	
		Water mg/L	Soil <sup>2</sup> mg/kg	Water mg/L	Soil <sup>2</sup> mg/kg	Water %	Soil <sup>2</sup> %	Water %	Soil <sup>2</sup> %	Water %	Soil <sup>2</sup> %	Water %	Soil <sup>2</sup> %	Water %	Soil <sup>2</sup> %
	<b>TCLP Volatiles:</b>														
1311/8260	1,1-Dichloroethylene	0.7		0.1		70-130		<50		70-130		<50		90	
1311/8260	1,2-Dichloroethane	0.5		0.1		70-130		<50		70-130		<50		90	
1311/8260	Benzene	0.5		0.1		70-130		<50		70-130		<50		90	
1311/8260	Carbon Tetrachloride	0.5		0.1		70-130		<50		70-130		<50		90	
1311/8260	Chlorobenzene	100		20		70-130		<50		70-130		<50		90	
1311/8260	Chloroform	6		1		70-130		<50		70-130		<50		90	
1311/8260	Methyl Ethyl Ketone	200		20		70-130		<50		70-130		<50		90	
1311/8260	Tetrachloroethylene	0.7		0.7		70-130		<50		70-130		<50		90	
1311/8260	Trichloroethylene	0.5		0.1		70-130		<50		70-130		<50		90	
1311/8260	Vinyl Chloride	0.2		0.05		70-130		<50		70-130		<50		90	
	<b>TCLP Semi-Volatiles:</b>														
1311/8270B	1,4-Dichlorobenzene	7.5		1		70-130		<50		70-130		<50		90	
1311/8270B	2,4,5-Trichlorophenol	400		80		70-130		<50		70-130		<50		90	
1311/8270B	2,4,6-Trichlorophenol	2		0.4		70-130		<50		70-130		<50		90	
1311/8270B	2,4-Dinitrotoluene	0.13		0.02		70-130		<50		70-130		<50		90	
1311/8270B	Cresol	200		40		70-130		<50		70-130		<50		90	
1311/8270B	Hexachlorobenzene	0.13		0.02		70-130		<50		70-130		<50		90	
1311/8270B	Hexachloroethane	3		0.5		70-130		<50		70-130		<50		90	
1311/8270B	Hexachlorobutadiene	0.5		0.4		70-130		<50		70-130		<50		90	
1311/8270B	Nitrobenzene	2		0.4		70-130		<50		70-130		<50		90	
1311/8270B	Pentachlorophenol	100		80		70-130		<50		70-130		<50		90	
1311/8270B	Pyridine	5		1		70-130		<50		70-130		<50		90	
	<b>TCLP Pesticides:</b>														
1311/8081	Chlordane	0.03		0.005		70-130		<50		70-130		<50		90	
1311/8081	Endrin	0.02		0.005		70-130		<50		70-130		<50		90	
1311/8081	Heptachlor	0.008		0.001		70-130		<50		70-130		<50		90	
1311/8081	Heptachlor Epoxide	0.008		0.001		70-130		<50		70-130		<50		90	
1311/8081	Lindane	0.4		0.05		70-130		<50		70-130		<50		90	
1311/8081	Methoxychlor	10		1		70-130		<50		70-130		<50		90	
1311/8081	Toxaphene	0.5		0.05		70-130		<50		70-130		<50		90	
	<b>TCLP Herbicides:</b>														
1311/8150	2,4,5-TP (Silvex)	0.01		0.001		70-130		<50		70-130		<50		90	
1311/8150	2,4-D	10		1		70-130		<50		70-130		<50		90	
	<b>TCLP-Metals</b>														
1311/6010	Arsenic	5.0		1.0		70-130		<50		70-130		<50		90	

Notes:

- 1) EPA SW 846 Methods unless otherwise specified
- 2) Includes Sediments, Waste, Solids
- 3) Lab's QC limits will substitute these limits--These are guidelines only

**Table A-2**  
**PROTECO TCLP PROJECT QUALITY CONTROL OBJECTIVES**

Method Number <sup>1</sup>	Analyte / Component	Project Action Limits		Minimum PQL		Accuracy Limits <sup>3</sup> MS/MSD recoveries		Precision Limits <sup>3</sup> MS/MSD deviation		Accuracy Limits <sup>3</sup> LCS recoveries		Precision Limits <sup>3</sup> Field Dup deviation		Completeness Limits	
		Water mg/L	Soil <sup>2</sup> mg/kg	Water mg/L	Soil <sup>2</sup> mg/kg	Water %	Soil <sup>2</sup> %	Water %	Soil <sup>2</sup> %	Water %	Soil <sup>2</sup> %	Water %	Soil <sup>2</sup> %	Water %	Soil <sup>2</sup> %
1311/6010	Barium	100.0		20.0		70-130		<50		70-130		<50		90	
1311/6010	Cadmium	1.0		0.2		70-130		<50		70-130		<50		90	
1311/6010	Chromium	5.0		1.0		70-130		<50		70-130		<50		90	
1311/6010	Lead	5.0		1.0		70-130		<50		70-130		<50		90	
1311/7470	Mercury	0.2		0.0		70-130		<50		70-130		<50		90	
1311/6010	Selenium	1.0		0.2		70-130		<50		70-130		<50		90	
1311/6010	Silver	5.0		1.0		70-130		<50		70-130		<50		90	
	<b>Characteristics</b>														
7.3	Reactive Cyanide	250	250	1.0	10	70-130	70-130	<50	<50	70-130	70-130	<50		90	
7.3	Reactive Sulfide	500	500	10.0	50	70-130	70-130	<50		70-130	70-130	<50		90	
9040/9045	pH	2-12.5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
9095	Paint Filter Test	NA	Pass	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Notes:

- 1) EPA SW-846 Methods unless otherwise specified
- 2) Includes Sediments, Waste, Solids
- 3) Lab's QC limits will substitute these limits--These are guidelines only

## **APPENDIX C**

**CHAIN-OF-CUSTODY  
CLASS 9 SHIPPING LABEL  
CUSTODY SEAL  
FED EX AIR BILL  
DIRECTIONS FOR COMPLETION OF AIRBILL**



# CHAIN-OF-CUSTODY RECORD

Form 0019  
Field Technical Services  
Rev. 03/88

No.62119

O.H. MATERIALS CORP. • P.O. BOX 551 • FINDLAY, OH 45830-0551 • 419-423-3526

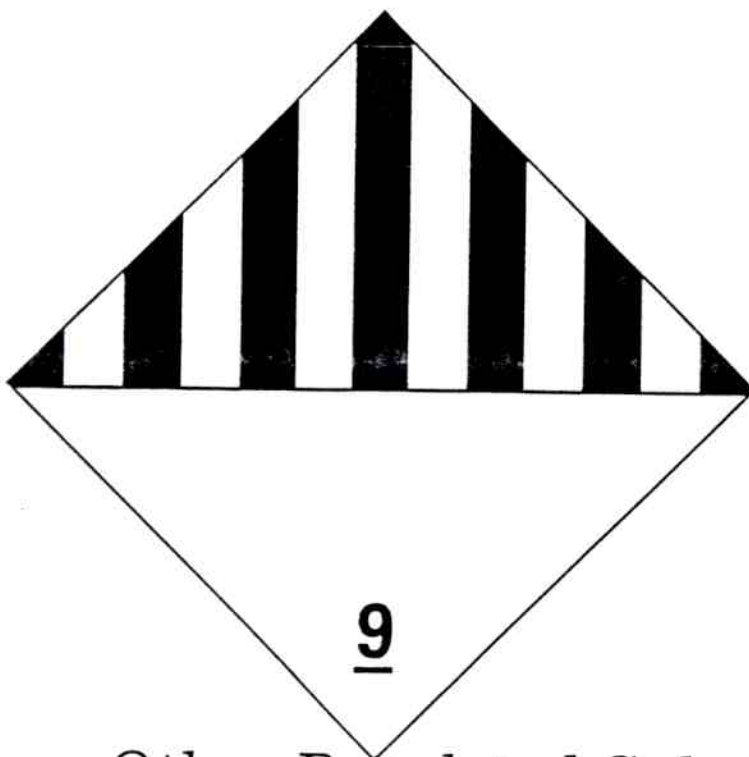
PROJECT NAME		PROJECT LOCATION				NUMBER OF CONTAINERS	ANALYSIS DESIRED (INDICATE SEPARATE CONTAINERS)										REMARKS			
PROJ. NO.	PROJECT CONTACT			PROJECT TELEPHONE NO.																
CLIENT'S REPRESENTATIVE			PROJECT MANAGER/SUPERVISOR																	
ITEM NO.	SAMPLE NUMBER	DATE	TIME	COMP	QUBS		SAMPLE DESCRIPTION (INCLUDE MATRIX AND POINT OF SAMPLE)													
1																				
2																				
3																				
4																				
5																				
6																				
7																				
8																				
9																				
10																				
TRANSFER NUMBER	ITEM NUMBER	TRANSFERS RELINQUISHED BY			TRANSFERS ACCEPTED BY			DATE	TIME	REMARKS										
1																				
2																				
3																				
4																				
															SAMPLER'S SIGNATURE					

PLEASE PRESS HARD. ALL 4 PARTS MUST BE READABLE.

CHAIN-OF-CUSTODY RECORD



OHM Corporation



OHM Corporation



From:

Phone:

To:

Phone:

Other Regulated Substances, ID# 8027

Class 9 Shipping Label



OHM Corporation

Client \_\_\_\_\_

Sample ID \_\_\_\_\_

Location \_\_\_\_\_

Analysis \_\_\_\_\_

Preservative \_\_\_\_\_

Collection Date/Time \_\_\_\_\_

Collected By \_\_\_\_\_

### CUSTODY SEAL

Person Collecting Sample \_\_\_\_\_ Sample No. \_\_\_\_\_  
(signature)

Date Collected \_\_\_\_\_ Time Collected \_\_\_\_\_

Custody Seal

Sample Label



OHM Remediation  
Services Corp.

# INDEX CONT.

.....



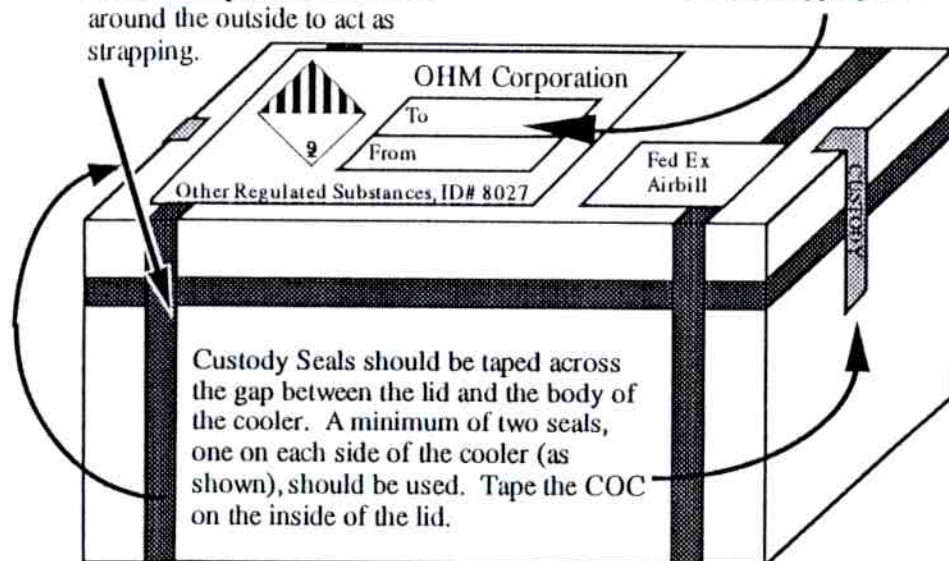
OHM Remediation  
Services Corp

## Shipping Instructions for Sending Samples to the Lab

NOTE: These procedures are ONLY for shipping unknown environmental samples such as sludge, soil, or water samples for laboratory analysis identification; Materials which are known to be explosive, compressed gases, flammable, oxidizers, poisons, radioactive, or corrosive cannot be shipped by this method. Call the Regional T&D Coordinator for help in that case. Drum or tank materials must be shipped as per the Regional T&D Coordinator's instructions.

Cooler lid is taped closed and additional tape should be used around the outside to act as strapping.

OHM custom sample shipping label



- 1) Samples must be shipped in "Strong outer packaging". Fed-Ex stated that a rigid plastic cooler like we are currently using would be acceptable.
- 2) Use one of OHM's custom sample shipping labels. The To/From address portion of the label should be filled out completely including phone numbers. This label should be placed on last and cannot be covered by tape, the Fed-Ex airbill or anything else. This label should go on the TOP of the cooler.
- 3) Inner packages cannot exceed 1 gallon each, and the entire shipment (cooler & samples) cannot exceed 66 lb.
- 4) Coolers must be packed with absorbent material (vermiculite or kitty litter) which will absorb any spills or leaks, not react with the sample contents, and which will minimize the chance that inner containers will break. The coolers should also be fastened shut securely using tape or strapping. See the SAI for special instructions.
- 5) Inner containers should have their lids securely closed and packed in a ziplock baggie to prevent leaks
- 6) The materials must be shipped using a Federal Express Hazardous Materials Airbill. Use the example above or call the Hazardous Materials group at Federal Express at (800) GO-FEDEX for more instructions on filling out this form.
- 7) The COC must be filled out completely, placed in a gallon zip-lock baggie, and taped to the inside lid of the cooler. A copy of the COC should be placed behind the airbill in the pouch on the outside of the cooler.

### Lower Portion of Fed-Ex DANGEROUS GOODS airbill

0792772120

Two completed and signed copies of this Declaration must be handed to the operator.

**WARNING**  
Failure to comply in all respects with the applicable Dangerous Goods Regulations may be in breach of the applicable law, subject to legal penalties. This Declaration must not, in any circumstances, be completed and/or signed by a consolidator, a forwarder or an IATA cargo agent.

Transport Details: ☒ **HAZARDOUS** ☐ **NON-HAZARDOUS**

Shipment type: ☒ **HAZARDOUS** ☐ **NON-HAZARDOUS**

NATURE AND QUANTITY OF DANGEROUS GOODS						Quantity and type of packing	Packing instruction	Authorization
Proper Shipping Name	Class or Division	UN ID No.	Packing Group	Label Code	Dangerous Goods Identification			
Other Regulated Substances	Class 9	ID 8027		NA		Plastic Box Containing _____ x 1 kg inner containers	906	

Additional Handling Information

I hereby declare that the contents of this consignment are fully and accurately described above by proper shipping name and are classified, packed, marked, and labeled, and are in all respects in the proper condition for transport by air according to the applicable International and National Government Regulations.

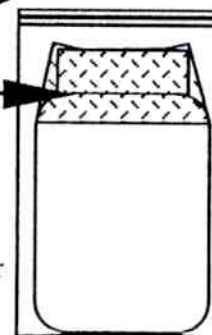
Emergency Telephone Number (Required for US Origin or Destination Shipments)

IF ACCEPTABLE FOR PASSENGER AIRCRAFT, THIS SHIPMENT IS: ☐ **HAZARDOUS** ☐ **NON-HAZARDOUS**

Signature and Date

Don't forget to sign and include the 24-hr Emergency Response Phone number. Check with the Regional T&D Coordinator for this number

Lids are taped to prevent leaks or loosening. Entire jar is sealed in a zip-lock baggie



Fill in the blank with the number of containers

- \_\_\_\_ x 1 kg for quart jars
- \_\_\_\_ x 500 g for 8 oz jars
- \_\_\_\_ x 40 g for VOA vials

Fill in the Additional Handling space with:

"Samples from OHM Job # \_\_\_\_\_ see attached chain of custody. In case of emergency refer to ICAO Emergency Response Guidance for Aircraft Incidents Involving Dangerous Goods drill #9A"

READ THE DIRECTIONS ON THE AIRBILL SO YOU UNDERSTAND WHAT YOU ARE FILLING OUT. Fill out the Fed-Ex airbill completely. Don't forget to sign the bottom and include the Emergency Response phone number. Changing even one thing from the example above may mean that Fed-Ex will refuse to accept the shipment. This procedure has been checked-out with Fed-Ex several times. If a driver refuses to pick it up make sure you have filled out the airbill right and followed ALL the instructions before you complain.

**CONSTRUCTION QUALITY ASSURANCE PLAN  
FOR THE  
PROTECCION TECNICA ECOLOGICA, INC.  
CLOSURE OF WASTE UNIT NUMBERS 1, 2,  
3, 5, 9, 10, 11, 12, 13, 16 AND 17**

Submitted to:

**Proteccion Tecnica Ecologica, Inc.  
Carr. 385 KM 3.5  
Penuelas, PR 00624**

Submitted by:

**OHM Remediation Services Corp.  
5335 Triangle Parkway, Suite 450  
Norcross, GA 30092**

September 1996

Project No. 16139

## TABLE OF CONTENTS

---

1.0	INTRODUCTION .....	1-1
2.0	RESPONSIBILITY AND AUTHORITY .....	2-1
2.1	Owner .....	2-1
2.2	CQA Officer .....	2-1
2.3	CQA Inspection Personnel .....	2-2
3.0	DOCUMENTATION .....	3-1
3.1	Daily Inspection Reports .....	3-1
3.2	Inspection and Testing Reports .....	3-2
3.3	Problem Identification and Corrective Action Reports .....	3-2
3.4	Drawings of Record .....	3-3
4.0	PROJECT MEETINGS .....	4-1
4.1	Preconstruction CQA Meeting .....	4-1
4.2	Daily Progress Meetings .....	4-2
4.3	Problem or Work Deficiency Meeting .....	4-2
5.0	SUB-BASE CONSTRUCTION AND INSPECTION TESTING .....	5-1
5.1	Material Specifications .....	5-1
5.2	Preconstruction Testing .....	5-1
5.3	Field Testing .....	5-1
5.4	CQA Inspection Personnel Responsibilities .....	5-2
6.0	LOW PERMEABILITY LAYER CONSTRUCTION AND INSPECTION TESTING .....	6-1
6.1	Material Specifications .....	6-1
6.2	Preconstruction Testing .....	6-1
6.2.1	Test Fill Program .....	6-1
6.2.1.1	Construction Equipment .....	6-2
6.2.1.2	Test Fill Material .....	6-2
6.2.1.3	Test Fill Construction .....	6-2
6.2.2	Inspection and Testing .....	6-5
6.2.3	Documentation .....	6-7
6.3	Low Permeability Layer Construction .....	6-8
6.4	Field Testing .....	6-10
6.5	Test Equipment Calibration .....	6-10
6.6	Nonconforming Test Results .....	6-10
6.7	Survey Control .....	6-11
7.0	GEOMEMBRANE CONSTRUCTION AND INSPECTION TESTING .....	7-1
7.1	Material Specifications .....	7-1
7.2	Manufacturer's Quality Assurance Meeting .....	7-1
7.3	Geomembrane Conformance Testing .....	7-1
7.4	Geomembrane Liner Installation .....	7-2
7.5	Field Testing .....	7-4
7.5.1	Trial Seams .....	7-4
7.5.2	Production Seams .....	7-5
7.6	Production Seam Laboratory Testing .....	7-6

## TABLE OF CONTENTS – CONTINUED

7.7	Destructive Test Seam Failure .....	7-7
7.8	Final Inspection and Defect Repair .....	7-7
7.9	Geomembrane Acceptance .....	7-8
8.0	<b>GEONET CONSTRUCTION AND INSPECTION TESTING .....</b>	<b>8-1</b>
8.1	Material Specifications .....	8-1
8.1.1	Quality Control Documentation .....	8-1
8.2	Conformance Testing .....	8-3
8.2.1	Sampling Procedures .....	8-3
8.2.2	Test Results .....	8-3
8.3	Geotextile Deployment .....	8-4
8.4	Seaming Procedures .....	8-4
8.5	Defects and Repairs .....	8-5
8.6	Geotextile Protection .....	8-5
9.0	<b>GEOTEXTILE CONSTRUCTION AND INSPECTION TESTING .....</b>	<b>9-1</b>
9.1	Material Specifications .....	9-1
9.1.1	Quality Control Documentation .....	9-1
9.2	Conformance Testing .....	9-2
9.2.1	Sampling Procedures .....	9-3
9.2.2	Test Results .....	9-3
9.3	Geonet Deployment .....	9-3
9.4	Seaming Procedures .....	9-4
9.5	Defects and Repairs .....	9-4
9.6	Geonet Protection .....	9-4
10.0	<b>COVER LAYER CONSTRUCTION AND INSPECTION TESTING .....</b>	<b>10-1</b>
10.1	Material Specifications .....	10-1
10.1.1	Cover Layer .....	10-1
10.1.2	Surface Armor Layer .....	10-1
10.1.3	CQA Inspection Personnel Responsibilities .....	10-1
10.2	Survey Control .....	10-2
11.0	<b>GAS VENTING SYSTEM CONSTRUCTION AND INSPECTION TESTING .....</b>	<b>11-1</b>
11.1	Material Specifications .....	11-1
11.2	Material Testing .....	11-1
11.3	CQA Inspection Personnel Responsibility .....	11-1
12.0	<b>CONSTRUCTION CERTIFICATION .....</b>	<b>12-1</b>
12.1	Acceptance Reports .....	12-1
12.2	Final Documentation .....	12-1
12.3	Document Control .....	12-1
12.4	Storage of Records .....	12-2

## TABLE OF CONTENTS – CONTINUED

---

### TABLES

Table 1	Tests for Sub-base at Borrow Source
Table 2	Tests for Sub-base <i>In Situ</i>
Table 3	Tests for Low Permeability Layer at Borrow Source
Table 4	Tests for Low Permeability Layer <i>In Situ</i>
Table 5	Required Properties of HDPE Geomembrane
Table 6	Manufacturer's Quality Assurance HDPE Resin Material Requirements
Table 7	Manufacturer's Quality Assurance Testing of Geomembrane
Table 8	Conformance Testing of Geomembrane
Table 9	Geomembrane Welded Seam Testing
Table 10	Required Properties of Geotextile
Table 11	Required Properties for Geonet
Table 12	Tests for Cover Layer at Borrow Source
Table 13	Tests for Cover Layer <i>In Situ</i>

## 1.0 INTRODUCTION

---

This Construction Quality Assurance (CQA) Plan has been prepared to provide a summary of the procedures and methods for construction of the final cover of the Proteccion Tecnica Ecologica, Inc. (Proteco) Waste Units 1,2,3,5,7,9,10,11,12,13,16, and 17 in Penuelas, Puerto Rico. This CQA Plan has been prepared in accordance with the United States Code of Federal Regulations (CFR), Title 40, Parts 264 & 265 and in accordance with applicable technical guidance documents published by the United States Environmental Protection Agency (EPA). The purpose of this plan is to establish standards for CQA inspection personnel which will ensure that the landfill cap is constructed in accordance with the approved plans. The elements of construction which require field monitoring and documentation by this plan include the sub-base, low permeability layer, geomembrane, drainage layer, cover layer, topsoil and surface armor layer.

## 2.0 RESPONSIBILITY AND AUTHORITY

---

### 2.1 OWNER

The Owner will be responsible for ensuring that the terms and conditions of the approved closure plan are fulfilled during construction through implementation of this CQA Plan. The Owner's representative on the site, herein after referred to as the Project Manager, will be responsible for coordination between the construction contractor(s) and the CQA inspection personnel, overall project management during construction, and implementation of the CQA Plan.

Prior to construction, the Project Manager, the contractor and the CQA Officer shall review the approved closure plan for clarity and completeness. In the event that additional clarification is needed, the design engineer will be consulted for the necessary clarification or modifications.

### 2.2 CQA OFFICER

The CQA Officer who shall be an independent party not responsible to the Construction Contractor, will be retained by the Owner during construction of the landfill cap. The CQA Officer must be a Professional Engineer, registered in Puerto Rico with experience in similar projects and considered to be qualified to perform. The CQA Officer shall promptly report all work items outside the scope of the project which may cause an increase in project cost to the Owner's Project Manager. Additionally, any disputes between the contractor and the CQA Officer, and questions and clarifications regarding the work shall be reported to the Project Manager. The CQA Officer will have comprehensive responsibility for construction quality assurance and will direct the construction inspection, testing and documentation efforts with specific responsibilities for the following activities:

1. Reviewing the CQA Plan as well as the construction plans and specifications for clarity and completeness;
2. Educating the CQA inspection personnel regarding the CQA requirements and procedures;
3. Scheduling and coordinating the CQA inspection activities;
4. Ensuring that the proper procedures are followed for field monitoring, sample collection and field and laboratory analyses;

5. Confirming that test data are accurately reported and maintained for later reporting;
6. Reviewing and interpreting all data sheets and reports associated with the construction activities and reporting them to the Owner;
7. Identifying work that should be accepted, rejected, uncovered for observations, or work that may require special testing, inspection or approval and reporting it to the Owner;
8. Rejecting defective work and verifying and recording that corrective measures have been implemented, and;
9. Furnishing the Owner and the Geosynthetic Installer with the results of all observations and tests as the work progresses, and coordinating with the contractor when modifications to the plans are necessary to ensure compliance with the design.

### 2.3 CQA INSPECTION PERSONNEL

All CQA inspection personnel shall be employed by the same firm as the CQA Officer or a firm retained by the CQA Officer. It is recommended that all CQA personnel be certified by the National Institute for Certification of Engineering Technologies (NICET) or equivalent education or experience to perform the CQA activities. The responsibilities of the CQA inspection personnel will include the following:

1. Conducting independent on-site inspection of construction activities to assess compliance with the approved plans and specifications;
2. Verifying that the equipment used for CQA testing meets the specified test requirements, and that all tests are conducted according to the CQA Plan procedures;
3. Reporting to the CQA Officer the results of all inspections, including work that is not of acceptable quality or that fails to meet the specified design;

## 3.0 DOCUMENTATION

---

### 3.1 DAILY INSPECTION REPORTS

Daily inspection reports shall be prepared by the CQA Officer and/or the CQA inspectors which shall include but not be limited to the following :

1. Date, project name, location, waste unit cap under construction, personnel involved in major activities and other relevant work-in-progress identification information;
2. Description of weather conditions, including temperature, cloud cover, wind speed, wind direction and precipitation;
3. Minutes of any meetings held and actions recommended or taken;
4. Specific work units and locations of construction underway during that particular day;
5. Documentation of all tests that were conducted and any observations made;
6. Description of the adequacy of the work performed;
7. Equipment and personnel being utilized in each work task, including subcontractors;
8. Identification of areas or units of work being inspected;
9. Unique identifying sheet number of geomembranes for cross referencing and document control;
10. Description of off-site materials received, including any quality control data provided by the supplier;
11. Calibration of test equipment, including actions taken as a result of calibration;
12. Decisions made regarding approval of units of material or of work, and/or corrective actions to be taken in instances of substandard or suspect quality;
13. Unique identifying sheet numbers of inspection sheets and/or problem reporting and corrective measures to be used to substantiate the CQA decisions described in the previous item;

14. The time period when work occurred (e.g. start, finish, lunch, downtime, standby, etc.); and
15. Signature of the CQA Officer or Inspector.

### **3.2 INSPECTION AND TESTING REPORTS**

All observations and results of field and laboratory tests performed on-site and/or off-site shall be recorded on a suitable data sheet. The CQA Officer shall submit the proposed data sheet to the Project Manager for approval thirty days prior to initiating construction activities. At a minimum, the inspection and testing data sheets should include the following information:

1. Description or title of the inspection activity
2. Location of the inspection activity or location from which the sample was obtained;
3. Type of inspection activity and procedure used (reference to standard method when appropriate or specific method described in this CQA plan);
4. Unique identifying geomembrane sheet number for cross referencing and document control;
5. Recorded observation or test data;
6. Results of the inspection activity (e.g. pass/fail) and comparison with specification requirements;
7. Personnel involved in the inspection other than the person preparing the data sheet, and;
8. Signature of the CQA inspector and review signature by the CQA Officer.

### **3.3 PROBLEM IDENTIFICATION AND CORRECTIVE ACTION REPORTS**

Any material or workmanship which does not meet the requirements of the construction plans, specifications and/or the CQA Plan shall be documented in a problem identification and corrective action report. At a minimum, the problem identification and corrective action report should include the following:

1. Location of the problem;
2. Description of the problem (in sufficient detail and with supporting sketches or photographic information where appropriate) to adequately describe the problem;
3. Unique identifying geomembrane sheet number for cross referencing and document control, if applicable;
4. Probable cause;
5. How and when the problem was located (reference to inspection data sheet or daily inspection report by inspector);
6. Where relevant, how long the problem has existed;
7. Any disagreement between the inspector and the contractor about whether or not a problem exists or the cause of the problem;
8. Suggested corrective actions;
9. Documentation of correction if corrective action was taken and completed prior to finalization of the problem and corrective measures report (reference to inspection data sheet, where applicable);
10. Where applicable, suggested methods to prevent similar problems, and;
11. Signature of the CQA inspector and review signature of the CQA Officer.

### 3.4 DRAWINGS OF RECORD

Drawings of Record (As-Built drawings) shall be prepared and certified by a Professional Engineer or a Registered Land Surveyor, registered in Puerto Rico, to document the actual lines and grade for each component of the landfill cap for each waste unit. These drawings shall also document the construction of the erosion and sediment control structures and appurtenances with specific reference to lines and grades of stormwater drainage swales, location of erosion control mats and sediment basin construction. Individual components of the cap shall be documented as follows:

1. Soil component - At a minimum, as-built drawings shall include survey data which identifies the bottom and top elevation measured to 0.03 meters (0.1 feet) of each particular component/layer (i.e. low permeability layer, drainage layer, cover, etc.)

measured on a 30 meters (100 feet) grid across each waste unit. The drawings shall also include the as-built plan dimensions of each layer (i.e. thickness at each grid point) and;

2. Geosynthetic component - At a minimum, as-built drawings shall include the dimensions of all geomembrane field panels, the location of each panel with the appropriate numbering/lettering, identification of all seams, and the location of all destructive test samples.

## 4.0 PROJECT MEETINGS

---

### 4.1 PRECONSTRUCTION CQA MEETING

A meeting will be held to discuss and resolve any uncertainties prior to the commencement of construction activities. At a minimum, the Owner's Project Manager, the CQA Officer, the Earthwork and/or Geosynthetic Installer and any major subcontractors should attend the meeting. The topics of the meeting should include, but not be limited to the following:

1. Introducing the parties and identifying their responsibilities and authority;
2. Ensuring each attendee has all CQA documents, specifications, and supporting information;
3. Discussing responsibilities and lines of communication;
4. Reviewing all aspects of the site-specific CQA plan to ensure a thorough understanding of the responsibilities, duties and inspection/monitoring procedures and addressing all questions and clarifications;
5. Discussing the established procedure or protocol for handling construction deficiencies, repairs and testing;
6. Reviewing methods for documenting and reporting inspection data, and for distributing and storing documents and reports;
7. Identifying any changes to the CQA Plan necessary to ensure that construction will be conducted in accordance with the approved plans;
8. Discussing quality control procedures that geosynthetics manufacturers will employ, and;
9. Discussing procedures for the location and protection of construction materials and for the prevention of damage to the materials from inclement weather or other adverse events.

## 4.2 DAILY PROGRESS MEETINGS

A progress meeting will be held daily at the work area just prior to commencement or just following completion of work. At a minimum, the meeting shall be attended by the Earthwork and/or Geosynthetic Installer and the CQA inspection personnel. The purpose of the meeting will be the following:

1. Review the previous day's activities and accomplishments;
2. Review the work locations and the activities for the day;
3. Identify the Contractor's personnel, and the equipment assignments for the day;
4. Discuss any potential construction problems.
5. Discuss schedule changes, upcoming events, etc.

Daily meetings shall be documented by a member of the CQA inspection personnel, and copies of the minutes shall be compiled into weekly summary reports for submission to the Owner no later than 1 week after the last day of the reporting period.

## 4.3 PROBLEM OR WORK DEFICIENCY MEETING

A special meeting may be held when and if a problem or deficiency is present or is likely to occur. At a minimum, the meeting shall be attended by the Contractor and the CQA inspection personnel. The purpose of the meeting will be to define and resolve a problem or a recurring work deficiency as follows:

1. Define and discuss the problem or deficiency;
2. Review alternative solutions, and;
3. Implement a plan to resolve the problem or deficiency.

These meetings shall be documented by a member of the CQA inspection personnel, and the documentation should be included in the weekly summary report.

## 5.0 SUB-BASE CONSTRUCTION AND INSPECTION TESTING

---

### 5.1 MATERIAL SPECIFICATIONS

A compacted soil layer will be constructed over the waste units to the elevations shown on the sub-base grading plan drawings. The material must possess an in-place compacted density equal to or greater than 95 percent of the Standard Proctor maximum dry density of the soil being utilized as determined by ASTM D-698. Testing and inspection methods necessary to ensure this in-place density are further detailed in the subsequent sections.

### 5.2 PRECONSTRUCTION TESTING

The moisture/density relationship and particle size to control actual field placement of the earth fill will be established using the test methods identified in Table 1. The procedure to establish the required criteria will be as follows:

1. A sample of the selected material which will be used to construct the sub-base layer will be taken to the laboratory;
2. A standard moisture density curve will be developed in accordance with the Standard Proctor Test ASTM D-698, and;
3. The point where 95% of maximum dry density will be interpreted from the curve to establish the necessary compaction effort.
4. The results of the sieve analysis will be compared to the design specifications.

### 5.3 FIELD TESTING

Prior to construction, trial field compaction of the material will be conducted to determine the number of passes necessary to compact the soil to the laboratory established compaction requirements.

As each lift is constructed, field testing will be conducted as described in Table 2 to ensure compliance with the established compaction and material requirements.

Field geotechnical testing results which demonstrate and in-place compacted density less than 95 percent of the Standard Proctor maximum dry density of the soil as determined by ASTM D-698 shall be considered nonconforming and required corrective action.

#### 5.4 CQA INSPECTION PERSONNEL RESPONSIBILITIES

In addition to supervising the performance of the field density testing and the documentation of the testing results, the CQA inspection personnel will be responsible for the following activities during construction:

1. Visual classification of the material prior to placement;
2. Coordination of additional laboratory analyses in the event that a change in soil property is observed or suspected;
3. Material inspection for large roots or rocks which may prohibit compaction to the specified level;
4. Verification that the material is placed in loose lifts, no greater than 23 centimeters (9 inches) in thickness;
5. Monitoring the addition of water to the material where required to ensure that it is applied uniformly and in the amounts required;
6. Inspection of the area subsequent to placement of additional lifts to ensure that the area is free of cracks, roots, or defects, and;
7. Review of the as-built survey to confirm construction to the elevations and slopes provided on the approved plans.
8. Identify deviations from the specifications which would be reported in the corrective measures reports and required corrective action.

**Table 1 – Tests for Sub-base at Borrow Source**

<i>Property</i>	<i>Test Method</i>	<i>Frequency (1)</i>
Water Content	ASTM D-3017 ASTM D-4643, or ASTM D-4959	5,000 CM (6,500 CY)
Water Content	ASTM D-2216	10% of the rapid method
Particle Size	ASTM D-422	5,000 CM (6,500 CY)
Standard Proctor	ASTM D-698	5,000 CM (6,500 CY)

**Table 2 – Tests for Sub-base *In Situ***

<i>Property</i>	<i>Test Method</i>	<i>Frequency (1)</i>
Water Content	ASTM D-3017 ASTM D-4643 ASTM D-4944, or ASTM D-4959	1,000 m <sup>2</sup> (10,000 ft <sup>2</sup> )
Water Content	ASTM D-2216	10% of the rapid method
Density (Rapid)	ASTM D-2922 ASTM D-2937	1,000 m <sup>2</sup> (10,000 ft <sup>2</sup> )
Density	ASTM D-1556 ASTM D-1587, or ASTM D-2167	5% of rapid methods
Construction Oversight	--	Continuous

- (1) If a change in material occurs, then the frequency will be reduced to provide data for the different material.

## 6.0 LOW PERMEABILITY LAYER CONSTRUCTION AND INSPECTION TESTING

---

### 6.1 MATERIAL SPECIFICATIONS

The 0.3 meters (2 feet) low permeability layer will be constructed with on-site materials in accordance with the permitted plans. The material when placed in the cap must possess a *in situ* coefficient of permeability (k) less than  $1 \times 10^{-7}$  cm/sec. Testing and inspection methods necessary to ensure this in-situ permeability are detailed in the subsequent sections.

The material will meet the following requirements in order to be classified as select fill for use in construction of the low permeability layer:

1. The material will be classified according to the Unified Soil Classification System (USCS) as CL or CH and;
2. Select low permeability fill materials will be reasonably free of gypsum, ferrous and/or calcareous concentrations and nodules, refuse, roots, or other deleterious substances.
3. The soil will exhibit a plasticity index (PI) of no less than 15 percent.

### 6.2 PRECONSTRUCTION TESTING

All soil to be used for construction of the low permeability layer will be inspected by the CQA inspection personnel. Rock fragments, boulders, and cobbles contained in the soil will not exceed 5 centimeters (2 inches) in any dimension. Material will be inspected to remove limbs, roots, and other deleterious material. Continuous and repeated visual inspection of the materials being used will be performed by the contractor to ensure that proper soils are being used.

The quality assurance tests specified in Table 3 will be performed on material that is to be used for construction at the specified frequencies and whenever a change in material occurs.

#### 6.2.1 Test Fill Program

The purpose of the test fill is to establish a sequential and logical approach for the development of placement and compaction procedures to be used during construction of cohesive soil liners as an indicator that the soil liners are constructed in a way that meets design performance specifications. The test fill program will allow the Contractor, the

Design Engineer, and the Construction Quality Assurance (CQA) Engineer to identify appropriate placement and compaction procedures by establishing relationships between various compaction parameters, density, water content, Atterberg limits, particle size distribution, and permeability of the fill.

Once the construction procedures have been established by the test fill program, the Contractor and the CQA Engineer will monitor the cohesive soil liner construction procedures as an indicator that the design performance specifications are being achieved. Test fill construction procedures will include measuring lift thickness, counting the number of compactor coverages, and performing in-place density and moisture content tests to verify that the specified degree of compaction is achieved.

The test fill will be constructed in uniform horizontal lifts of uniform thicknesses.

This test fill program documents the requirements for constructing the test fill. The test fill program will include:

- Subgrade preparation
- Construction of a 3-foot thick test fill
- Inspection and testing of the test fill
- Sampling of portions of the test fill

The test fill program described may be modified based on site specific and construction considerations.

Feasibility testing of clay sources will have been performed before the start of the test fill. These tests should provide the basis relationship of permeability with varying density and moisture content.

#### 6.2.1.1 Construction Equipment

The equipment to be used for the test fill will be proposed by the Contractor, and approved by the CQA Engineer and Project Manager.

#### 6.2.1.2 Test Fill Material.

Test fill material will be that proposed for construction of the low permeability layer.

#### 6.2.1.3 Test Fill Construction

##### *Subgrade Preparation*

The area within the limits of the test fill will be cleared and grubbed of all trees, debris, bushes, stumps, roots, trash, and any other vegetation or objectionable material. Following

clearing and grubbing, the area will be stripped of topsoil. Topsoil will be stockpiled in an area designated by the Project Manager.

The surface of the subgrade will be proof-rolled so as to be free of soft zones, irregularities, loose earth, and abrupt changes in grade. The subgrade and test fill will be sloped at a 2 percent grade. No standing water or excessive moisture will be allowed on the surface of the subgrade. The surface will be inspected by the CQA Engineer prior to beginning construction of the test fill.

### *Configuration*

The test fill will be a rectangle approximately 20 meters (60 feet) long by 10 meters (20 feet) wide. The test fill will be constructed to a thickness of 1 meter (3 feet) in uniform horizontal lifts. Lines and grades will be controlled by survey.

### *Fill Placement*

The test fill will be constructed in uniform horizontal lifts to a total thickness of 1 meter (3 feet) after compaction in accordance with the procedures specified below. The procedures, which vary with the lift considered, are intended to allow determination of a relationship between soil compaction criteria, which include density and moisture content, permeability, and compaction method parameters. Compaction method parameters include: 1) compactor characteristics, 2) thickness of compacted/uncompact layers, 3) number of compactor coverages, and 4) soil moisture content.

### *First Lift*

1. The first lift of test fill material will be placed to a thickness resulting in 0.15 meters (6 inches) after compaction.
2. Soil moisture content will be maintained between -2 and +4 percent of the optimum water content determined by the CQA Engineer. The Contractor will adjust the moisture content as necessary to obtain the specified density criteria.
3. The test fill material will be compacted with two 1-way coverages using the Contractor's proposed compaction equipment.
4. The Contractor will permit the CQA Engineer to perform in-place density tests and collect soil samples.
5. Holes left in the lift will be repaired in accordance with methods outlined in the CQA plan. The repairs will be compacted using procedures which have been shown to meet the required moisture and density criteria.

6. The test fill material will be compacted a second time by applying two more 1-way coverages with the selected compactor.
7. Steps 4 and 5 will be repeated. Second tests will be taken near the original tests.
8. The test fill material will be compacted a third time by applying two more 1-way coverages with the selected compactor.
9. Steps 4 and 5 will be repeated. Third tests will be taken near the first and second tests.
10. Steps 8 and 9, respectively, will be repeated and continued until specified compaction criteria are obtained as identified by the CQA Engineer.

#### *Second Lift*

1. The loose thickness of the second lift will be such that the thickness of the lift will be 0.15 meters (6 inches) after compaction.
2. A competent bond with the first lift will be achieved by the Contractor and approved by the CQA Engineer.
3. Steps 2 through 10 of the previous section will be repeated.

#### *Remaining Lifts*

1. The loose thickness of the remaining lifts will be such that the thickness of the lifts will be 0.15 meters (6 inches) after compaction.
2. The procedures for compacting and testing the remaining lifts will be those that have been tested and proven effective during the compaction of the second lift.

#### *Final Surface Preparation*

The surface of the test fill will be rolled with a smooth steel drum or pneumatic roller so as to be free of irregularities, loose earth, and abrupt changes in grade. All stones larger than 2.54 centimeters (1 inch) will be removed. Stones which are smaller than 2.54 centimeters (1 inch) and are judged to be detrimental to a geomembrane liner will be removed.

### 6.2.2 Inspection and Testing

#### *Test Fill Material*

The CQA Engineer will perform testing on the low permeability layer prior to its use in the test fill. Testing will include at least the following:

- Soil density/moisture content relationship using the Standard Proctor compaction method (ASTM D-698)
- Natural water content (ASTM D-2216)
- Particle size distribution (ASTM D-422)
- Atterberg limits (ASTM C-4318)
- Soil classification (ASTM D-2487)

#### *Subgrade Preparation*

The CQA Engineer will observe the prepared subgrade for firmness, smoothness, and absence of abrupt changes in grade.

#### *Test Fill Construction*

##### *Lift Compaction*

For the first and second lifts, the CQA Engineer will perform the following activities:

- Estimate the thickness of the loose lifts
- Count the number of compactor coverages and observe compactor coverage of the test fill
- At every two coverages, perform a minimum of eight nuclear gauge in-place density and moisture readings (ASTM D-2292) and a minimum of two in-place density tests using the sand-cone method (ASTM D-1556) to verify the nuclear gauge readings; compute degree of compaction (i.e., in-place dry density divided by the Standard Proctor maximum dry density); collect four additional soil samples for moisture content determination (ASTM D-2216)
- Observe the repair of holes left in the lift as a result of density testing and soil sample collection

- Continue in-place density testing and moisture content determination to enable development of a curve giving in-place dry density versus number of compactor coverages for each lift thickness

For each of the remaining lifts, the CQA Engineer will perform the following activities:

- Verify that the thickness of the loose lift does not exceed the loose thickness determined from testing of the second lift
- Count the number of compactor coverages, determined from testing of the second lift, which are necessary to achieve the specified density and observe compactor coverage of the test fill
- Perform a minimum of eight nuclear density tests and two sand-cone density tests per lift to verify the adequacy of the construction procedures previously established

The CQA Engineer will collect a minimum of six undisturbed Shelby tube samples from varying depths of the completed test fill. The samples will be waxed or otherwise protected to retain natural moisture and tested in the laboratory for the following:

- Hydraulic conductivity
- Dry density
- Particle size distribution (ASTM D-422)
- Atterberg limits (ASTM D-4318)
- Soil classification (ASTM D-2487)
- Soil moisture content (ASTM D 2216)

The CQA Engineer will observe the test fill to verify the adequacy of the bonding between adjacent lifts. Such observation will be exercised on the portion of the test fill which has been excavated to permit removal of undisturbed soil block samples or the sand-cone density testing.

#### *Final Surface Preparation*

The CQA Engineer will observe the prepared surface for firmness, smoothness, and absence of abrupt changes in grade.

#### *Permeability Testing*

The permeability of the test fill will be assessed by performance of a minimum of four laboratory tests on specimens trimmed from the Shelby tube samples tested at a location selected by the CQA Engineer.

### *Test Results*

The test results which will be used to verify that the specified construction procedures meet the design performance criteria will be:

- Compaction testing (i.e., degree of compaction, in-place dry density, and moisture content)
- Results of laboratory permeability testing performed on undisturbed soil samples
- Soil index testing to evaluate material suitability

### *Lines and Grades*

The following surfaces will be surveyed to verify that proper thicknesses have been constructed:

- Prepared surface of the grade
- Final surface of the test fill

### **6.2.3 Documentation**

The CQA Engineer will document activities associated with the construction, monitoring, and testing of the test fill. Such documentation will include daily reports of construction activities and oral communications with the Contractor. In addition, the following will be documented for each of the sections listed below.

#### *Test Fill Material*

The CQA Engineer will provide a moisture density relationship for the test fill liner material and other test results.

#### *Test Fill Construction*

##### *Subgrade Preparation*

The CQA Engineer will document observations on subgrade preparation.

#### *Test Fill*

The CQA Engineer will document activities of the test fill construction, monitoring and testing in a test fill summary report, which shall include but not be limited to:

- Record of the compactor type, configuration, and weight; for sheepfoot compactors, record the drum diameter and length, empty and ballasted weight, length and face area of feet, and yoking arrangement, if any
- Record thicknesses of lifts prior to and after compaction

- Record density versus number of compactor coverages for each lift thickness
- Record the number of compactor coverages which will provide the specified degree of compaction and permeability
- Record the procedure to bond lifts
- Results of moisture, in-place density and degree of compaction
- Repair of holes left in the lift as a result of density testing and soil sample collection
- Results of laboratory permeability testing and other soil properties tests performed on undisturbed soil samples
- As-built drawing of the test fill and locations of all test samples for each lift
- Cross-section of the test fill showing number of lifts and lift thickness
- Description of actual construction procedures
- Observations of test fill excavation for removal of undisturbed soil samples and observations of layer bonding

### 6.3 LOW PERMEABILITY LAYER CONSTRUCTION

Low permeability fill material will be applied such that lift thicknesses are no greater than a 23 centimeter (9 inches) loose lift. Thinner lifts are permissible to achieve design grade. Prior to compaction, each lift of fill material will be thoroughly disced to provide soil particle sizes less than 10 centimeters (4 inches) in diameter. In order to ensure that the low permeability layer becomes one continuous mass of clay from the bottom to the top of the layer, the surface of each lift must be maintained at the specified moisture content and it must be scarified when covered by the succeeding lift. Equipment or truck traffic on the surface will not be permitted during the period between scarifying and placement of the following lift.

After scarifying, representative samples will be taken of the material to be used as the next lift, and tested for moisture content prior to any compactive efforts. If the moisture content is within the range specified placement and compaction may begin. If the moisture content is not within this range, the fill material will be moistened or dried and reworked accordingly. The fill should be sprinkled or sprayed with water from a water truck and

dozed, windrowed, and/or disc plowed to uniformly increase the moisture content of the material if the moisture content is less than 2 percent of the optimum moisture content (as determined from the Standard Proctor Analysis). The fill material should be dozed, windrowed, and/or disc plowed to uniformly help air dry the material if the moisture content is more than 4 percent above the optimum moisture content (as determined from the Standard Proctor Analysis). The required moisture content range either side of optimum may be adjusted by the CQA Officer during construction, once a database of moisture content, density and permeability is developed.

Each lift will be thoroughly compacted and satisfy moisture and density requirements through field testing before a subsequent lift is placed. Compaction of lifts will be conducted as follows:

1. A 10,000 kg (10 ton) properly ballasted penetrating foot compactor will be utilized subject to approval from the CQA personnel. A minimum of 6 passes will be required on each lift regardless of whether the lift meets density specifications. This requirement is to allow thorough remolding of the soil by kneading action;
2. The daily work area will extend a distance no greater than necessary to maintain moist soil conditions which facilitates soil bonding and continuous operations. Desiccation and crusting of the lift surface shall be avoided as much as possible;
3. If desiccation and crusting of the lift surface occurs before placement of the subsequent lift, this area will be sprinkled with water, scarified and tested for water content to ensure proper moisture control before placement of the subsequent lift;
4. Transition from full depth layer to beginning of adjacent new section will be accomplished by sloping the end of a full depth section at a 5H:1V slope or flatter for tying in a new lift, and;
5. Dozer or scraper equipment shall not be used for primary compaction efforts.

The select fill will be compacted to a minimum of 95 percent of the maximum dry density as determined from the Standard Proctor Test. Densities less than 95 percent will be reworked to comply with density criteria.

During construction, finished lifts or sections of compacted select soil will be sprinkled with water as needed to prevent drying and desiccation. At the end of each construction day's activities, completed lifts or sections of compacted soil will be sealed by rolling with a rubber tired or smooth drum roller and sprinkled with water as needed. Desiccation cracks greater than 0.3 centimeters (1/8 inch) will not be allowed.

The compacted low permeability layer will be no less than 0.6 meters (2 feet) thick across the waste unit. The as-built thickness of the compacted low permeability layer will be determined by non-destructive survey methods described below. An individual lift may be sampled upon completion with an approved sampler or other investigative tool with the resulting penetration properly backfilled with hand tamped fill or bentonite pellets.

After completion of construction of the low permeability layer and prior to installation of the geomembrane, the top of the low permeability layer will be surveyed to ensure that the specified thickness of the compacted low permeability layer has been achieved.

#### 6.4 FIELD TESTING

Table 4 contains the test methods and frequency which will be utilized for testing the *in situ* low permeability layer.

#### 6.5 TEST EQUIPMENT CALIBRATION

All field test equipment will be maintained under the control of the CQA inspection personnel. The CQA inspection personnel will be fully trained in the use of the equipment, test procedures, and interpretation of results for each piece of test equipment. Copies of the calibration certificates will be maintained on-site and by the CQA Officer. The equipment will be calibrated in accordance with the equipment manufacturer's Quality Assurance procedures.

Calibration of nuclear density gauges will conform to the frequencies outlined in ASTM D-2922-78 and ASTM D-3017-78. Unstable or erratic nuclear density gauges will not be used for testing and will immediately be removed from the site.

#### 6.6 NONCONFORMING TEST RESULTS

Test locations which fail to meet criteria will be required to receive modifications to have the soil conditions adjusted to comply with the CQA requirements. The area defined as non-conforming will be identified by tests which show density and moisture content to be within the limits required by the specifications. The non-conforming area will be reworked and retested until it fulfills the specifications.

Laboratory permeability test results which demonstrate a permeability greater than  $1 \times 10^{-7}$  cm/sec will immediately be brought to the attention of the CQA Officer. Non-conforming permeability test results will initiate an immediate re-evaluation of compaction criteria and a review of all permeability results from low permeability layer samples.

All non-conformance reports will be brought to the Project Managers attention by the CQA Officer and will be documented in the final report.

## 6.7 SURVEY CONTROL

The following procedures will be followed with respect to the survey of the completed low permeability layer:

1. The completed low permeability layer surface will be surveyed before the placement of the geomembrane to ensure that the constructed thickness and elevations fulfill the approved plans and specifications;
2. A minimum of one cross-section for every 30 meters (100 feet) of cell length and width shall be surveyed. At a minimum, survey points will be established at the top, mid-point, bottom and slope breaks of each waste unit. These survey points will be coincident with cross section lines laid out for the top of the sub-base layer;
3. Acceptable tolerances on survey coordinates will be  $\pm 0.06$  meters ( $\pm 0.2$  feet) on elevations and  $\pm 0.3$  meters ( $\pm 1.0$  foot) on coordinates. The low permeability layer will be greater than or equal to the thickness specified;
4. The CQA inspection personnel certifying the survey results will be either a Registered Land Surveyor or a Professional Engineer licensed in Puerto Rico and;
5. The CQA officer will certify that the low permeability layer meets the thickness requirements in the plans and specifications and submit confirmatory documentation to the Project Manager.

Table 3 – Tests for Low Permeability Layer at Borrow Source		
<i>Property</i>	<i>Test Method</i>	<i>Frequency (1)</i>
Water Content (Rapid)	ASTM D-3017 ASTM D-4643 ASTM D-4944, or ASTM D-4959	5,000 m <sup>3</sup> (6,500 ft <sup>3</sup> )
Water Content	ASTM D-2216	10% of the rapid methods
Atterberg Limits	ASTM D-4318	5,000 m <sup>3</sup> (6,500 ft <sup>3</sup> )
Percent Fines	ASTM D-1140	5,000 m <sup>3</sup> (6,500 ft <sup>3</sup> )
Percent Gravel	ASTM D-422	5,000 m <sup>3</sup> (6,500 ft <sup>3</sup> )
Standard Proctor	ASTM D-698	5,000 m <sup>3</sup> (6,500 ft <sup>3</sup> )
Hydraulic Conductivity	ASTM D-5084	10,000 m <sup>3</sup> (13,000 ft <sup>3</sup> )

Table 4 – Tests for Low Permeability Layer <i>In Situ</i>		
<i>Property</i>	<i>Test Method</i>	<i>Frequency (1)</i>
Water Content (Rapid)	ASTM D-3017 ASTM D-4643 ASTM D-4944, or ASTM D-4959	1,000 m <sup>2</sup> /lift (10,000 ft <sup>2</sup> /lift)
Water Content	ASTM D-2216	10% of the rapid methods
Total Density (Rapid)	ASTM D-2922, or ASTM D-2937	1,000 m <sup>2</sup> /lift (10,000 ft <sup>2</sup> /lift)
Total Density	ASTM D-1556 ASTM D-1587, or ASTM D-2167	5% of rapid methods
Hydraulic Conductivity	ASTM D-5084	5,000 m <sup>2</sup> /lift (50,000 ft <sup>2</sup> /lift)
Construction Oversight	Observation	Continuous

- (1) If a change in material occurs, then the frequency will be reduced to provide data for the different material.

## 7.0 GEOMEMBRANE CONSTRUCTION AND INSPECTION TESTING

---

### 7.1 MATERIAL SPECIFICATIONS

Overlaying the low permeability layer will be a (nominal) 40 mil. thick high density polyethylene (HDPE) smooth geomembrane. Standard specifications for the HDPE geomembrane are presented in Table 5. The chemical resistance of the geomembrane sheet and seams will be in accordance with typical properties of high quality polyethylene products currently available through commercial sources. The geomembrane will be shipped in roll form. The contractor will submit the proposed geomembrane panel layouts to the CQA Officer and the Owner's Project Manager for review and approval. Once the panel layout is approved, the Contractor may not alter the approved layout without the knowledge and formal approval of the CQA Officer and the Owner's Project Manager.

### 7.2 MANUFACTURER'S QUALITY ASSURANCE TESTING

Prior to shipment of any HDPE material to the site the Contractor or the geomembrane manufacturer will submit the results of the material testing to the CQA Officer and the Project Manager for review and approval. Minimum testing requirements and frequencies that must be performed are provided in Tables 5 and 6.

### 7.3 GEOMEMBRANE CONFORMANCE TESTING

Conformance testing of the geomembrane sheet will be performed on samples collected at the factory from rolls that will be used in the project or from samples collected after the geomembrane is received at the landfill. The purpose of this conformance testing is to verify that the geomembrane meets the required specifications. At a minimum, the conformance testing will consist of samples collected every 100,000 square feet of geomembrane and tested for the criteria listed in Table 8.

If a roll does not fulfill all of the criteria in Table 8, that roll may be rejected at no cost to the Owner. All rolls that are in sequence with the failing roll will also be considered to be failing. If data from existing testing or additional testing performed to minimize the number of failing rolls indicates that they are passing rolls then those rolls may be reassigned to be passing. Testing to reassign failing sequences of rolls will only be for failing criteria and not the entire suite of tests.

## 7.4 GEOMEMBRANE LINER INSTALLATION

The geomembrane cap will be constructed as soon as practical after the low permeability layer is completed. Areas which will be overlain by the geomembrane shall be relatively smooth and even, and free of roots, voids, rocks, stones, sticks, sharp objects, etc.

Deployment of geomembrane will be performed in weather conditions that are consistent with the installer's health and safety procedures and such that the geomembrane is not damaged. Each sequential section of geomembrane will be continuously welded to adjacent sections. An anchor trench will be required to anchor the geomembrane. Precautions will be taken to minimize the amount of loose soil underlying the geomembrane in the anchor trenches. The time schedule for excavation and backfilling of the anchor trench will be approved by the CQA inspection personnel so that desiccation of soils in the exposed sections of the trench does not occur prior to backfilling. The installation procedures of the geomembrane will be as follows:

1. Unroll only those portions of the geomembrane which will be seamed together or anchored in one day. Panels will be positioned with an overlap of no less than 11 centimeters (4 inches). The edge of the upslope sheet will be positioned above the edge of the downslope sheet.
2. After the panels are in place, remove as many wrinkles as possible. Unroll several panels and allow the geomembrane to "relax" prior to commencing field seaming.
3. When the panels are in place and smooth, field seaming may begin.
4. The anchor trench shall then be backfilled with compacted soil. Compaction shall be to a minimum of 85 percent of the maximum dry density, as determined by the Standard Proctor Test, ASTM D-698;

Field seaming will be conducted as follows:

1. All foreign matter (dirt, water, oil, etc.) will be removed from the edges of the geomembrane to be bonded. For extrusion type welds, the bonding surfaces must be thoroughly cleaned by mechanical abrasion or a similar method, approved in advance and in writing by the CQA Officer, to remove surface cure and prepare the surface for bonding. All abrasive buffing will be performed using No. 80 grit or finer sandpaper. The grinding will be performed so that any and all grind marks are perpendicular to the edge of the sheet. No solvents may be utilized to clean the geomembrane;

2. As much as practical, field seaming will start from the top of the slope, in order to prevent any wrinkles resulting from activities on the slope behind the area that is being seamed. Tack welds (if used) will be formed by heat only. No double sided tape, glue or other method will be permitted. The geomembrane will be seamed completely to the ends of all panels to minimize the potential for tear propagation along the seam. The completed liner should not exhibit any "trampolining" during daylight hours, and;
3. At the end of each day or at the end of each panel placement, all unseamed edges will be anchored by sand bags or other device approved by the CQA inspection personnel. Staples, U-shaped rods or other penetrating anchors may not be used to secure the geomembrane.

Field seaming may be extrusion or fusion welding or a combination of these methods. Solvent welding will not be acceptable. The CQA Officer has the authority to reject any proposed seaming method other than extrusion or fusion welding. Proper field seaming methods and requirements include the following:

1. Extrusion welding applies a molten bead of material to preheated sheets of geomembrane. The sheets are then heat tacked and joined by pressure;
2. The fusion welding process heats the area to be joined to the melting point and then pressure is applied to join the melted surfaces;
3. The sheets to be joined will be overlapped a minimum of 10 centimeters (4 inches).
4. The seams should be oriented parallel to the line of maximum slope (i.e. up and down the slope, not across). In corners and odd geometric shaped locations the number of field seams should be minimized;
5. No seaming shall be attempted above 49°C (110°F) ambient air temperature or below 6°C (35°F) ambient air temperature, as measured 15 centimeters (6 inches) above the geomembrane surface. Any modifications to this criteria must be in writing from the CQA consultant.
6. A moveable protective layer of plastic may be required to be placed directly below each overlap of geomembrane that is to be field seamed. This is to prevent any moisture build up between the sheets to be welded;
7. Seaming will extend to the outside edges of panels to be placed in anchor trenches;

8. If required, a firm working surface should be provided by using a flat board or similar hard surface directly under the seam overlap to achieve proper support;
9. No excessive grinding prior to welding will be permitted. Overground or improperly ground areas will be replaced, and;
10. Seams at panel intersections of 3 or more panels will be completed with a patch having a minimum size of 0.6 meters (2 feet) square.

## **7.5 FIELD TESTING**

Testing of the seams will be performed by the Contractor, under supervision of the CQA personnel. Testing requirements for test seams, as well as for production seams are detailed in the subsequent sections.

### **7.5.1 Trial Seams**

The contractor will maintain and use equipment and personnel at the site to conduct field testing of trial seams. Trial seams will be formed each day prior to beginning field seaming. These trial seams will be formed on fragment pieces of the geomembrane to verify that seaming conditions are adequate. Trial seams will be formed three times per day per welding apparatus/operator combination in the beginning of the day, at midday, and at the close of day. The requirements for trial seams are as follows:

1. The trial seam sample will be at least 1 meter (3 feet) long by 0.3 meters (1 foot) wide with the seam centered over the length of the test strip. Six adjoining specimens 2.54 centimeters (1 inch) wide will be die cut from the trial seam. These specimens will be tested in the field with a tensiometer for both shear and peel. Three test strips will be tested for shear and three test strips will be tested for peel. The test seams will be tested by the contractor under the supervision of the CQA inspection personnel. The specimens will only be acceptable if the type of separation is of a Film Tearing Bond type in which the geomembrane material tears before the weld. The contractor will supply all necessary testing equipment and shall ensure that personnel are present who are qualified to conduct the testing. No strain measurements will be required of field testing. A machine or hand welded test seam considered passing will meet or exceed the criteria in Table 9. If a test seam does not comply with the criteria listed in Table 9, another trial seam shall be made and the entire testing procedure will be repeated. If the repeat trial seam fails, the seaming apparatus or the seamer will not be accepted and will not be used for seaming until the deficiencies are corrected and two consecutive trial seams meet the criteria listed in Table 9, and;

2. The CQA inspection personnel will observe all trial seam procedures. All trial seams will be assigned a number and marked accordingly by the CQA inspection personnel. The information to be recorded will include but not be limited to the following:

- A. Test Number
- B. Date
- C. Time
- D. Ambient temperature
- E. Seaming unit number
- F. Name of seamer
- G. Pass or fail description

The remaining portion of the trial seams will be retained. At least one tested specimen from each test as selected by the CQA personnel will be retained. The CQA inspection personnel will transmit these specimens to the Owner following acceptance of the geomembrane materials.

#### **7.5.2 Production Seams**

Production seams will be non destructively tested by the contractor over the entire length of the seam. Destructive testing will be performed at intervals along the production seams as described below.

##### **A. Non-destructive Testing**

Single weld seams will be tested by the Contractor utilizing a vacuum box. The vacuum box will be capable of applying and maintaining a vacuum of at least (5 psi). Testing single weld seams will be accomplished by brushing a soapy solution on the seamed area to be tested. The vacuum box will then be placed over the wetted area. A vacuum of 35 kPa (5 psi) will be applied for a minimum of 15 seconds. Any areas where soap bubbles are generated shall be marked and repaired as described later in this section.

Hot weld seams will be tested by the Contractor by pressurizing the interstitial space between the two welds. This will be accomplished by sealing both ends of the seam to be tested and inducing pressure utilizing a needle or other approved pressure feeding device into the weld interstice. A minimum pressure of 210 kPa (30 psi) will be induced on the weld. If the pressure loss exceeds 20 kPa(3 psi) after a period of five minutes, or does not stabilize, the seam will be repaired as described later in this section.

#### B. Destructive Testing

Destructive test samples will be taken at a minimum frequency of one test no greater than 150 meters (500 feet) of each welding machine's track. Test locations shall be determined during seaming. Locations may be prompted by appearance of excess heating, contamination, offset welds, or suspected defect. The CQA inspection personnel shall be responsible for choosing the locations. The CQA inspection personnel shall not notify the Geomembrane Installer in advance of selecting locations where seam samples will be taken.

The Geomembrane Installer shall cut samples at locations designated by the CQA inspection personnel as the seaming progresses to obtain laboratory test results before the geomembrane is covered. The CQA inspection personnel shall number each sample and mark the sample number and location on the panel layout drawing.

The Geomembrane Installer shall immediately repair all holes in the geomembrane resulting from destructive sampling. The continuity of the repair shall be vacuum tested in accordance with this Section.

The destructive sample shall be 0.5 meter (18 inches) wide by 1 meter (36 inches) long with the seam centered lengthwise. The sample shall be cut into three equal parts for distribution, one to the Geomembrane Installer, one to the CQA Laboratory, and one to the Owner for archiving.

Destructive samples shall be obtained on a daily basis as seaming progresses. Collecting all samples at the completion of seaming shall be allowed.

### 7.6 PRODUCTION SEAM LABORATORY TESTING

Laboratory testing of destructive test samples will be performed by the CQA Laboratory. Samples will be tested in peel and shear (ASTM D-4437 as modified by NSF 54). Minimum acceptable stress to be obtained for these tests shall be as described in Table 9.

All tests shall exhibit a Film Tearing Bond type of separation in which the geomembrane material tears before the weld. At least five coupons shall be tested by each test method. Five of five coupons shall meet minimum requirements. Coupons from each sample shall be selected alternately for testing (i.e., peel, shear, peel, shear...). For double-wedge seam samples, both welds shall be tested in peel. Test results shall be provided verbally within 24 hours after receiving samples and within seven days in written form.

## 7.7 DESTRUCTIVE TEST SEAM FAILURE

In the event destructive testing results in a production seam failure, the seam will be repaired as follows:

- a. Option 1: Reconstruct the seam between any two passed test locations.
- b. Option 2: Trace the weld to a location at least 3 meters (10 feet) from the sample location, in both directions from the location of the failed test. Check the next seam welded using the same welding device if required to obtain additional sample (i.e., if one side of the seam is less than 3 meters (10 feet) long. Samples shall be taken at these offset locations and destructive testing shall be performed per this section. If these offset samples pass, then the seam shall be reconstructed between the test sample locations. If any additional samples fail, then the process shall be repeated to establish the zone in which the seam shall be reconstructed.

Reconstruction methods shall include extrusion welding of previously hot wedge welded seams, cap stripping of seam, or replacing seam with a new 0.3 meters (1 foot) wide panel and welded in place.

Acceptable seams shall be bound by two locations from which samples have passed destructive tests. For reconstructed seams exceeding 15 meters (50 feet), a sample taken from within the reconstructed seam shall also pass destructive testing. Whenever a sample fails, additional testing may be required for seams that were welded by the same welder and welding apparatus or were welded during the same shift.

## 7.8 FINAL INSPECTION AND DEFECT REPAIR

Prior to final acceptance, the CQA inspection personnel will examine the geomembrane for defects, holes, blisters, undispersed raw materials, and any sign of contamination by foreign matter. The Installer will clean the geomembrane surface at the time of the examination. Each suspect location shall be repaired and non-destructively tested. Geomembrane shall not be covered at locations which have been repaired until test results with passing values are available. Damaged geomembrane shall be removed and replaced with acceptable geomembrane if damage cannot be satisfactorily repaired.

Any portion of the geomembrane exhibiting a flaw, or failing a destructive or non-destructive test shall be repaired. The Geomembrane Install shall be responsible for repair of damaged or defective areas. Procedures available include:

1. Patching – Used to repair large holes over 1 centimeter (3/8-inch) in diameter, and tears over 5 centimeters ( 2 inches) long, undispersed raw materials, and contamination by foreign matter.
2. Abrading and Re-welding – Used to repair small seam sections less than 0.3 meters (12 inches) long.
3. Spot Welding – Used to repair small tears less than 5 centimeters (2 inches) long, pinholes, or other minor localized flaws.
4. Capping – Used to repair large lengths of failed seams.
5. Removing the unsatisfactory material and replacing with new material.

Geomembrane surfaces which are to be repaired utilizing an extrusion weld shall be abraded by the Geomembrane Installer no more than 1/2-hour prior to the repair. Patches or caps shall extend at least 5 centimeters (6 inches) beyond the edge of the defect and all corners of material to be patched. The corners of the patches shall be rounded to a radius of at least 8 centimeters (3 inches). The geomembrane below large caps shall be cut to avoid water or gas collection between the two sheets.

Each patch repair shall be non-destructively tested using methods specified in this Section. Destructive testing may be required at the discretion of the CQA inspection personnel.

## **7.9 GEOMEMBRANE ACCEPTANCE**

The Geomembrane Installer shall retain ownership and responsibility for the geomembrane until final acceptance by the Owner. Owner will accept the geomembrane installation when the installation is finished and all required documentation from the Geomembrane Installer has been received and approved, and verification of the adequacy of all field seams and repairs, including associated testing, is complete.

Table 5 – Required Properties of HDPE Geomembrane		
<i>Property</i>	<i>Test Method</i>	<i>Standard</i>
Thickness, mil	ASTM D-1593	≥36/40 (1)
Sheet Density, g/cm <sup>3</sup> (min.)	ASTM D-1505	≥0.94
Min. Tensile Properties a. Tensile strength at break, (lb/in) b. Tensile strength at yield (lb/in) c. Elongation at break, % d. Elongation at yield, %	ASTM D-638 – Type IV Dumbbell at 2 ipm	≥160 ≥95 ≥700 ≥13
Tear Resistance, lbs., (min)	ASTM D-1004, Die C	≥30
Low Temperature Impact, °F (max.)	ASTM D-746-B	≤-112
Dimensional Stability, % (max.)	ASTM D-1204 212 °F, 1 hour	±2.0
Environmental Stress Crack (min. hours with no failure)	ASTM C-1693, Method B (10%, Igepal, 50°C)	≥2,000
Puncture Resistance, lbs. (min.)	FTMS 101 (Method 2065)	≥52
Carbon Black Content, %	ASTM D-1603	2.0 – 3.0
Carbon Black Dispersion (acceptable levels)	ASTM D-3015	A1, A2 or B1

(1) The first value represents the lowest individual value; the second value represents the roll average.

Table 6 – Manufacturer's Quality Assurance HDPE Resin Material Requirements			
<i>Test</i>	<i>Test Designation</i>	<i>Units</i>	<i>Requirements</i>
Specific Gravity (1)	ASTM C-1505 A	g/cc	≥0.935
Melt Index (1)	ASTM D-1238 E	g/10 min.	≤0.5

(1) Testing to be performed at a minimum frequency of one per resin batch number.

Table 7 – Manufacturer's Quality Assurance Testing of Geomembrane			
<i>Property</i>	<i>Test Method</i>	<i>Frequency</i>	<i>Requirements (1)</i>
Thickness, mil	ASTM D-1593	10,000 SM 100,000 SF	≥36/40 (1)
Sheet Density, g/cm <sup>3</sup> (min.)	ASTM D-1505	10,000 SM 100,000 SF	≥0.94
Min. Tensile Properties a. Tensile strength at break, (lb/in) b. Tensile strength at yield (lb/in) c. Elongation at break, % d. Elongation at yield, %	ASTM D-638 – Type IV Dumbbell at 2 ipm	10,000 SM 100,000 SF	≥160 ≥95 ≥700 ≥13
Tear Resistance, lbs., (min)	ASTM D-1004, Die C		≥30
Dimensional Stability, % (max.)	ASTM D-1204 212°F, 1 hour		±2.0
Puncture Resistance, lbs. (min.)	FTMS 101 (Method 2065)		≥52
Carbon Black Content, %	ASTM D-1603		2.0 – 3.0
Carbon Black Dispersion (acceptable levels)	ASTM D-3015		A1, A2 or B1

(1) The first value represents the lowest individual value; the second value represents the roll average.

Table 8 – Conformance Testing of Geomembrane		
<i>Property</i>	<i>Test Method</i>	<i>Requirements (1)</i>
Thickness, mil	ASTM D-1593	≥36/40 (1)
Sheet Density, g/cm <sup>3</sup> (min.)	ASTM D-1505	≥0.94
Min. Tensile Properties a. Tensile strength at break, (lb/in) b. Tensile strength at yield (lb/in) c. Elongation at break, % d. Elongation at yield, %	ASTM D-638 – Type IV Dumbbell at 2 ipm	≥160 ≥95 ≥700 ≥13
Carbon Black Content, %	ASTM D-1603	2.0 – 3.0
Carbon Black Dispersion (acceptable levels)	ASTM D-3015	A1, A2 or B1

(1) The first value represents the lowest individual value; the second value represents the roll average.

Table 9 – Geomembrane Welded Seam Testing	
<i>Test</i>	<i>Minimum Acceptable Stress (lb/in width)</i>
Shear Strength	86
Peel Adhesion	
- Wedge Weld	57
- Extrusion Weld	48

## 8.0 GEOTEXTILE INSTALLATION AND INSPECTION TESTING

---

### 8.1 MATERIAL SPECIFICATIONS

The geotextile shall be made of non-woven material comprised of continuous yarns of polyester or polypropylene fibers, oriented into a stable network by needle punching that will retain its structure during handling, placement, and long term service. The geotextile shall be capable of withstanding direct exposure to sunlight for 30 days with no measurable deterioration. The geotextile shall conform to the following listed in Table 10.

#### 8.1.1 Quality Control Documentation

Prior to the installation of any geotextile, the Manufacturer or Geosynthetic Installer will provide the Project Manager with the following information.

1. The origin (resin supplier's name and production plant) and identification (brand name or number) of the resin used to manufacture the geotextile.
2. Copies of the quality control certificates issued by the resin supplier.
3. Reports on tests conducted by the Manufacturer to verify that the quality of the resin used to manufacture the geotextile meets the Manufacturer's resin specifications.
4. Reports on quality control tests conducted by the Manufacturer to verify that the geotextile manufactured for the project meets the project specifications.
5. A statement that the reclaimed polymer added to the resin during manufacture was done with appropriate cleanliness.
6. A list of the materials which comprise the geotextile, expressed in the following categories as percent by weight: base polymer, carbon black, and other additives.
7. A written certification that the Manufacturer has continuously inspected the geotextile for the presence of needles and found the geotextile to be needle free.
8. Quality control certificates, signed by a responsible party employed by the Manufacturer. The certificates will include roll identification numbers, sampling procedures, and results of quality control tests. Results for at least one roll will be

supplied for each 10,000 m<sup>2</sup> (100,000 SF) supplied to the project. At a minimum, results shall be given for the following properties.

- Thickness
- Mass per unit area
- Grab strength
- Trapezoidal tear strength
- Burst strength
- Puncture strength

The ASTM Methods identified in Table 10 will be used to determine the properties listed above. All rolls will be identified with the following:

- Manufacturer's name
- Product identification
- Roll number
- Roll dimensions

9. Appropriate quality control documentation to demonstrate that in-plane transmissivity of the drainage layer geotextile meets the design specifications in Section 02282.

The CQA Consultant will review these documents and report any discrepancies with the requirements to the Project Manager. The CQA Consultant will verify the following.

1. Property values certified by the Manufacturer meet all of its guaranteed specifications.
2. Measurement of properties by the Manufacturer are properly documented and that the test methods are acceptable.
3. Quality control certificates have been provided at the specified frequency for all rolls and that each certificate identifies the rolls related.
4. Roll packages are appropriately labeled.
5. Certified minimum average roll properties meet the project specifications.

## 8.2 CONFORMANCE TESTING

Upon delivery of the rolls of geotextile, the CQA Consultant will ensure that conformance test samples are obtained for the geotextile. These samples will then be forwarded to the Geosynthetic Laboratory for testing to ensure conformance to the project specifications. The minimum testing that will be performed on the geotextile samples are the following.

- Thickness
- Mass per unit area
- Grab strength
- Trapezoidal tear strength
- Burst strength
- Puncture strength

The ASTM Methods identified in Table 10 will be used to determine the properties listed above. Unless otherwise specified, samples will be taken at a rate of one per 10,000 m<sup>2</sup> (100,000 SF) per batch.

### 8.2.1 Sampling Procedures

The rolls to be sampled shall be selected by the CQA Consultant. Samples shall be taken across the entire width of the roll and shall not include the first 1 meter (3 feet). Unless otherwise specified, samples shall be 1 meter (3 feet) long by the roll width. The CQA Consultant shall mark the machine direction on the samples with an arrow.

A lot shall be defined as a group of consecutively numbered rolls from the same manufacturing line. Alternatively, a lot may be designated by the CQA Consultant based on a review of all roll information including quality control documentation and manufacturing records.

### 8.2.2 Test Results

All conformance test results shall be reviewed and accepted or rejected by the CQA Consultant prior to the deployment of the geomembrane. The CQA Consultant will examine all results from the laboratory conformance testing and will report any nonconformance to the Project Manager. The CQA Consultant will be responsible for checking that all test results meet or exceed the property values listed in the project specifications.

If any tests fail, the protocol that is described in Section 7.3 can be implemented to resolve any discrepancies.

### 8.3 GEOTEXTILE DEPLOYMENT

During, shipment and storage, the geotextile shall be protected from ultraviolet light exposure, precipitation, or other inundation, mud, dirt, dust, puncture, cutting, or any other damaging or deleterious conditions. Geotextile rolls will be shipped and stored in relatively opaque and watertight wrappings. Wrappings will not be removed until shortly before deployment. The CQA Consultant will observe all rolls upon delivery at the site any deviations from the above requirements will be noted.

The Geosynthetic Installer will handle all geotextiles in such a manner as to ensure they are not damaged in any way, the following construction criteria will apply:

1. On slopes, the geotextiles will be securely anchored and then rolled down the slope in such a manner as to keep the roll in continuous tension.
2. In the presence of wind, the geotextile will be securely weighted with sandbags or the equivalent. These anchorings will be placed during deployment and left until replaced with permanent cover.
3. Geotextiles will be cut using a geotextile cutter (hook blade) only. If in place, special care will be taken to protect other material from damage.
4. The Geosynthetic Installer will take any necessary precautions to prevent damage to underlying layers during placement of the geotextile.
5. During placement of the geotextile, care will be taken not to trap, in or beneath the geotextile, stones, excessive dust, or moisture that could damage the geomembrane, cause clogging of drains or filters, or hamper subsequent seepage.
6. A visual examination of the geotextile will be carried out over the entire surface, after installation, to ensure that no potentially harmful foreign objects, such as needles, are present.

### 8.4 SEAMING PROCEDURES

On slopes steeper than 10 horizontal to 1 vertical, all geotextiles will be continuously sewn (i.e., spot sewing is not allowed). Geotextiles will be overlapped a minimum of 8 centimeters (4 inches) prior to seaming. In general, no horizontal seams will be allowed on side slopes except as part of a patch. On bottoms and slopes shallower than 10:1, geotextiles can be seamed perpendicular to the slope as necessary. The Geosynthetic

Installer will pay particular attention at seams to ensure that no earth material can be inadvertently inserted beneath or through the seam.

Any sewing will be performed using polymeric thread with chemical and ultraviolet light resistance properties equal to or exceeding those of the geotextile. Sewing will be done using machinery and stitch types specified in the project specifications.

## **8.5 DEFECTS AND REPAIRS**

Any holes or tears in the geotextile will be repaired. On slopes, a patch made from the same geotextile shall be sewn in accordance with the project specifications. Should any tear exceed ten percent of the width of the roll, that roll will be removed from the slope and replaced. Care will be taken to remove any soil or other material which may have penetrated the torn geotextile.

## **8.6 GEOTEXTILE PROTECTION**

All soil materials located on top of a geotextile will be deployed in such a manner as to ensure:

1. The geotextile and underlying lining materials are not damaged.
2. Minimal slippage of the geotextile on underlying layers occurs.
3. No excess tensile stresses occur in the geotextile.

Unless specified, all lifts of soil will be as specified in the project specifications and drawings. If portions of the geotextile are exposed, the CQA Consultant should periodically place two marks on the geotextile known distances (i.e. 3 meters (10 feet)) apart along a slope to measure the elongation of the geotextile during the placement of soil.

**Table 10 – Required Properties of Geotextile**

<i>Property</i>	<i>Test</i>	<i>Units</i>	<i>Minimum Average Roll Value (MARV)</i>
Weight	ASTM D-3776	kg/m <sup>2</sup> (oz/SY)	0.26 (10)
Thickness	ASTM D-1777	mm (mil)	3.17 (125)
Grab Tensile Strength	ASTM D-4632	N (lb)	1,356 (305)
Grab Tensile Elongation to Break	ASTM D-4632	%	60
Mullen Burst Strength	ASTM D-3786	kPa (psi)	3,576 (510)
Puncture Resistance	ASTM D-4833 Modified	N (lb)	578 (130)
Trapezoidal Tear	ASTM D-4583	N (lb)	445 (100)
Water Permeability	ASTM D-4491	cm/sec.	0.34
Apparent Opening Size	ASTM D-4751	mm (U.S. sieve size)	0.149 to 0.125 (100 to 120)
UV Resistance	ASTM D-4355	%	70

## 9.0 GEONET INSTALLATION AND INSPECTION TESTING

---

### 9.1 MATERIAL SPECIFICATIONS

The geonet shall be manufactured of select high density polyethylene material and will have aperture geometry and rib and junction cross-sections sufficient to permit significant mechanical interlock with the material to be reinforced.

The geonet shall conform to the following requirements listed in Table 11.

#### 9.1.1 Quality Control Documentation

Prior to the installation of any geonet, the Manufacturer or Geosynthetic Installer will provide the Project Manager with the following information.

1. The origin (resin supplier's name and production plant), identification (brand name or number), and production date of the resin used to manufacture the geotextile.
2. Copies of the quality control certificates issued by the resin supplier.
3. Reports on tests conducted by the Manufacturer to verify that the quality of the resin used to manufacture the geonet meets the Manufacturer's resin specifications.
4. Reports on quality control tests conducted by the Manufacturer to verify that the geonet manufactured for the project meets the project specifications.
5. A statement indicating that the amount of reclaimed polymer added to the resin during manufacture was done with appropriate cleanliness and does not exceed 2% by weight.
6. A list of the materials which comprise the geonet, expressed in the following categories as percent by weight: polyethylene, carbon black, and other additives.
7. A specification for the geonet which includes values for all properties listed in the project specification measured using the appropriate test methods.
8. A written certification that minimum values given in the specifications are guaranteed by the Manufacturer.
9. Quality control certificates, signed by a responsible party employed by the Manufacturer. The certificates will include roll identification numbers, sampling

procedures, and results of quality control tests. Results for at least one roll will be supplied for a minimum of each 10,000 m<sup>2</sup> (100,000 ft<sup>2</sup>) of geonet supplied to the project. At a minimum, results shall be given for the following properties.

- Mass per unit area
- Measurement of spacing between strands
- Wide stripe tensile strength
- Node strength

The ASTM Methods identified in Table 11 will be used to determine the properties listed above. All rolls will be identified with the following:

- Manufacturer's name
- Product identification
- Roll number
- Roll dimensions

The CQA Consultant will review these documents and report any discrepancies with the requirements to the Project Manager. The CQA Consultant will verify the following.

1. Property values certified by the Manufacturer meet all of its guaranteed specifications.
2. Measurement of properties by the Manufacturer are properly documented and that the test methods are acceptable.
3. Quality control certificates have been provided at the specified frequency for all rolls and that each certificate identifies the rolls related.
4. Roll packages are appropriately labeled.
5. Certified minimum average roll properties meet the project specifications.

## 9.2 CONFORMANCE TESTING

Upon delivery of the rolls of geonet or at the Manufacturer's factory, the CQA Consultant will ensure that conformance test samples are obtained for the geonet. These samples will then be forwarded to the Geosynthetic Laboratory for testing to ensure conformance to the project specifications. The minimum testing that will be performed on the geonet samples are the following.

- Mass per unit area
- Measurement of spacing between strands
- Wide strip tensile strength

The ASTM Methods identified in Table 11 will be used to determine the properties listed above. Unless otherwise specified, samples will be taken at a rate of one per 10,000 m<sup>2</sup> (100,000 ft<sup>2</sup>) per batch.

#### **9.2.1 Sampling Procedures**

The rolls to be sampled shall be selected by the CQA Consultant. Samples shall be taken across the entire width of the roll and shall not include the first 1 meter (3 feet). Unless otherwise specified, samples shall be 1 meter (3 feet) long by the roll width. The CQA Consultant shall mark the machine direction on the samples with an arrow.

A lot shall be defined as a group of consecutively numbered rolls from the same manufacturing line. Alternatively, a lot may be designated by the CQA Consultant based on a review of all roll information including quality control documentation and manufacturing records.

#### **9.2.2 Test Results**

All conformance test results shall be reviewed and accepted or rejected by the CQA Consultant prior to the deployment of the geonet. The CQA Consultant will examine all results from the laboratory conformance testing and will report any nonconformance to the Project Manager. The CQA Consultant will be responsible for checking that all test results meet or exceed the property values listed in the project specifications.

If any tests fail, the protocol that is described in Section 7.3 can be implemented to resolve any discrepancies.

### **9.3 GEONET DEPLOYMENT**

During, shipment and storage, the geonet shall be protected from mud, dirt, dust, cutting, or any other damaging or deleterious conditions. Geonet rolls will be shipped and stored in relatively opaque and watertight wrappings. Wrappings will not be removed until shortly before deployment. The CQA Consultant will observe all rolls upon delivery at the site. Any deviations from the above requirements will be noted.

The Geosynthetic Installer will handle all geonet in such a manner as to ensure they are not damaged in any way, the following construction criteria will apply:

1. On slopes, the geonets will be securely anchored and then rolled down the slope in such a manner as to keep the roll in continuous tension. If necessary, the geonet shall be positioned by hand after being unrolled to minimize wrinkles.
2. In the presence of wind, the geonet will be securely weighted with sandbags or the equivalent. These anchorings will be placed during deployment and left until replaced with permanent cover.
3. Geonet shall only be cut using scissors or other cutting tools approved by the Project Manager that will not damage the underlying geosynthetics. Care shall be taken not to leave tools in the geonet.
5. The Geosynthetic Installer will take any necessary precautions to prevent damage to underlying layers during placement of the geotextile.

#### **9.4 SEAMING PROCEDURES**

Adjacent geonet shall be joined according to construction drawings and specifications. At a minimum, the following requirements shall be met:

1. Adjacent rolls will be overlapped by at least 0.62 meters (2 feet).
2. Pin the beginning of the roll to the ground with 0.15 meter (6 inch) "U" staples or other approved fasteners, pull the geonets tight by hand to take up the slack. Anchor only the roll ends; the geonet will conform to the ground surface.

#### **9.5 DEFECTS AND REPAIRS**

Any damaged roll of geonet shall be discarded. No repairs shall be allowed.

#### **9.6 GEONET PROTECTION**

- A. Thin fill lifts over the subgrade may not be sufficient to support loads of fill and heavy equipment. Low ground pressure tractors and low tire pressure (less than 11.71 kg/cm<sup>2</sup> - 4 psi) are recommended for hauling and spreading fill over these conditions. Do not operate equipment directly on the geonet. Insure that at least 0.1 meter (4 inches) of sand is between the geonet and the vehicle.
- B. Back dump specified fill onto the geonet where the subgrade is most stable. Spread the fill material over the geonet towards the softer subgrade.

- C. Grade fill material to the project specified thickness. Raise the blade gradually as the fill is pushed over the geonet material. This causes much of the fill to roll out onto the geonet and reduces stresses on the subgrade.
- D. Back dump subsequent loads onto the leveled fill and advance forward by spreading with the dozer.

Table 11 – Required Properties for Geonet			
<i>Property</i>	<i>Test</i>	<i>Units</i>	<i>Standard</i>
Thickness	ASTM D-1777	mm (mil)	≥5.33
Aperture Size		cm	25.4 x 25.4
Resin Density	ASTM D-1505	g/cm <sup>3</sup>	≥0.94
Carbon Black Content	ASTM D-1603	%	≥2
Tensile Strength	ASTM C-5035	kg/m (lbs/in)	≥705
Elongation	ASTM D-5035	%	≥212
Mass Per Unit Area	ASTM D-3776	kg/m <sup>2</sup> (lbs/ft <sup>2</sup> )	≥660

## 10.0 COVER LAYER CONSTRUCTION AND INSPECTION TESTING

---

### 10.1 MATERIAL SPECIFICATIONS

#### 10.1.1 Cover Layer

The cover layer will be constructed utilizing borrow materials currently available on-site. The material to be used will consist of soil free of stones greater than 10 centimeters (4 inches) in any dimension, sticks and other deleterious material. This soil will be placed as a controlled fill in loose lifts not to exceed 0.3 meters (12 inches) in depth to ensure uniform compaction of the fill material. Also, the moisture content of the material will be controlled to ensure adequate compaction is achieved and any excessive erosion and differential settlement will be kept to a minimum. The CQA inspection personnel will collect samples of the material proposed for use as a cover and have the soil analyzed as shown in Table 12.

Additionally as the material is being placed, the CQA inspection personnel will monitor the placement of the cover soil layer for moisture and density in accordance with Table 13.

#### 10.1.2 Surface Armor Layer

In areas designated on the plans as receiving a layer of surface armor as the final surface treatment, 15 centimeters (6 inches) layer of stone will be placed over the cover layer subsoil to serve as a permanent erosion control measure. The surface armor will consist of stone ranging in size from 5 centimeters (2 inches) to 10 centimeters (4 inches).

#### 10.1.3 CQA Inspection Personnel Responsibilities

During the cover layer construction and testing, the CQA inspection personnel will be responsible for the following activities:

1. Visual classification of the proposed fill material prior to placement;
2. Coordination for additional laboratory analyses in the event that a change in soil property is observed or suspected;
3. Inspection of material loads to ensure that foreign material has not been included;
4. Monitoring placement operations to verify that soil and/or stone is placed to the thickness and elevations shown on the drawings;

5. Inspection of fertilizer, lime and seed packaging (or sod) to verify placement in accordance with the approved drawings or SCS recommendations.

## 10.2 Survey Control

The following procedures will be followed with respect to the survey of the completed cover layer:

1. The completed cover layer surface will be surveyed to ensure that the constructed thickness and elevations correlate with those required by the approved plans and specifications;
2. A minimum of one cross-section for every 30 meters (100 feet) of cell length and width shall be surveyed. At a minimum, survey points will be established at the top, mid-point, bottom and grade breaks of each waste unit. These survey points will be coincident with cross section lines laid out for the top of the sub-base layer;
3. Acceptable tolerances on survey coordinates will be  $\pm 6$  centimeters ( $\pm 0.2$  feet) on elevations and  $\pm 0.3$  meters ( $\pm 1.0$  foot) on coordinates. The cover layer will be greater than or equal to the thickness specified;
4. The CQA inspection personnel certifying the survey results will be either a Registered Land Surveyor or a Professional Engineer licensed in Puerto Rico and;
5. The CQA officer will certify that the cover layer meets the requirements in the plans and specifications and submit confirmatory documentation to the Project Manager.

Table 12 – Tests for Cover Layer at Borrow Source		
<i>Property</i>	<i>Test Method</i>	<i>Frequency (1)</i>
Water Content (Rapid)	ASTM D-3017 ASTM D-4643 ASTM D-4944, or ASTM D-4959	5,000 m <sup>3</sup> (6,500 ft <sup>3</sup> )
Water Content	ASTM D-2216	10% of the rapid methods
Standard Proctor	ASTM D-698	10,000 m <sup>3</sup> (13,000 ft <sup>3</sup> )
Hydraulic Conductivity	ASTM D-5084	10,000 m <sup>3</sup> (13,000 ft <sup>3</sup> )

Table 13 – Tests for Cover Layer <i>In Situ</i>		
<i>Property</i>	<i>Test Method</i>	<i>Frequency (1)</i>
Water Content (Rapid)	ASTM D-3017 ASTM D-4643 ASTM D-4944, or ASTM D-4959	1,000 m <sup>2</sup> /lift (10,000 ft <sup>2</sup> /lift)
Water Content	ASTM D-2216	10% of the rapid methods
Total Density (Rapid)	ASTM D-2922, or ASTM D-2937	1,000 m <sup>2</sup> /lift (10,000 ft <sup>2</sup> /lift)
Total Density	ASTM D-1556 ASTM D-1587, or ASTM D-2167	5% of rapid methods
Construction Oversight	Observation	Continuous

(1) If a change in material occurs, then the frequency will be reduced to provide data for the different material.

## 11.0 GAS VENTING SYSTEM

---

### 11.1 MATERIAL SPECIFICATIONS

Pipes and fittings will be constructed of High Density Polyethylene (HDPE) smooth wall pipe, SDR 17 and will be a Type III, Class C, Category 5, Grade P34 material described in ASTM D-1248. Stone to be utilized in the trenches will be #57 stone as listed in ASTM D-448.

### 11.2 MATERIAL TESTING

A certification from the manufacturer stating that the pipes meet the physical property requirements described above will be obtained prior to construction. Grain size analyses will be performed on the aggregate prior to placement in accordance with ASTM C-136 by the stone manufacturer.

### 11.3 CQA INSPECTION PERSONNEL RESPONSIBILITY

During the gas vent installation the CQA inspection personnel will be responsible for the following activities:

1. Inspection of materials upon receipt and prior to placement;
2. Verification that materials are stored in accordance with manufacturer's recommendations;
3. Verification that construction activities are performed in accordance with the plans, and;
4. Verification that the piping system is constructed in accordance with the plans.

## 12.0 CONSTRUCTION CERTIFICATION

---

### 12.1 ACCEPTANCE REPORTS

All daily inspection reports, inspection data sheets and problem identification and corrective measures reports, will be reviewed by the CQA Officer. The documentation will be evaluated and analyzed for internal consistency with similar work.

This information will be assembled monthly and summarized into acceptance reports for submittal to the Owner. These reports should indicate that the materials and construction processes comply with the approved drawings.

### 12.2 FINAL DOCUMENTATION

At the completion of the project, a final certification report will be issued by the CQA Officer and transmitted to the Owner. This document will include, but not be limited to the following:

1. All daily field reports;
2. All laboratory and field test results;
3. Test methods;
4. Evaluation of all test reports with respect to project specifications;
5. Any non-conformance reports and corrective action reports;
6. Personnel involved with the project and their respective qualifications;
7. As-built drawings and survey notes certified by a Registered Land Surveyor, licensed in Puerto Rico, and;
8. Certification of final construction as meeting or exceeding construction drawings and specifications.

### 12.3 DOCUMENT CONTROL

The CQA Officer will initiate a filing system which will include, but not be limited to the following:

1. File copy of all Quality Assurance procedures, updated as necessary;
2. Photographic construction documentation;
3. Survey measurements;
4. Field and laboratory test results;
5. Daily and weekly field results and reports;
6. Field certification reports including as-built drawings;
7. Non-conformance and corrective action reports, and;
8. Minutes of construction meetings.

#### **12.4 STORAGE OF RECORDS**

During all construction activities, the CQA Officer will be responsible for all facility CQA Documents. This includes the CQA Officer's copy of the design plans, the CQA Plan, and the originals of all the data sheets and reports. The CQA Officer will supply all originals or copies of documentation for the CQA effort. These will be submitted bound in a folder or binder, indexed in a neat and orderly manner.

## SECTION 02282

### GEOTEXTILE

#### PART 1 - GENERAL

##### 1.01 SUMMARY

- A. This section includes furnishing and installing geotextile to be installed on the closure cover of the landfill between the geomembrane and the vegetation cover.

##### 1.02 RELATED WORK

- A. Section 02210: Grading
- B. Section 02220: Sub-Base Preparation
- C. Section 02221: Low Permeability Layer
- D. Section 02223: Cover Layer
- E. Section 02281: Geomembrane

##### 1.03 APPLICABLE STANDARDS

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only. Use the latest revision date available unless otherwise indicated.

American Society of Testing Materials (ASTM) Annual Book of Standards

ASTM D-3786	Hydraulic Bursting Strength of Knitted Goods and Nonwoven Fabrics: Diaphragm Bursting Strength Tester Method.
ASTM D-4491	Water Permeability of Geotextiles by Permittivity.
ASTM D-4533	Trapezoidal Tearing Strength of Geotextiles.
ASTM D-4632	Breaking Load and Elongation of Geotextiles (Grab Method).
ASTM D-4751	Determining the Apparent Opening Size of a Geotextile.
ASTM D-4833	Index Puncture Resistance of Geotextiles, Geomembranes, and Related Products.
ASTM D-5199	Measuring Nominal Thickness of Geotextiles and Geomembranes.
ASTM D-5261	Measuring Mass Per Unit Area of Geotextiles.

#### 1.04 SHIPPING, HANDLING, AND STORING

- A. Rolls of geotextile shall be marked or tagged with; manufacturer's name, product identification, lot number, roll number, roll dimensions.
- B. The geotextile shall be stored off of the ground, rolled and covered to protect from ultraviolet light exposure, precipitation or other inundation, mud, dirt, dust, puncture, cutting or any other damaging deleterious conditions.

### PART 2 - PRODUCTS

#### 2.01 GEOTEXTILE

- A. The geotextile shall be a continuous filament polyester or polypropylene nonwoven needle punched fabric.
- B. The polyester or polypropylene filaments shall be formed into a stable network such that the filaments retain their relative position.
- C. The fabric shall be inert to commonly encountered chemicals, biological degradation, hydrocarbons, acids, alkalies, and mildew. The fabric shall be resistant to rot, ultraviolet light, insects, and rodents.
- D. Reworked fibers or polymer, that are of the same composition as the new fibers or polymer, may be incorporated into the geotextile to a maximum of 20 percent by weight. The manufacturer shall provide a statement indicating the amount and type of reworked fibers or polymer were actually added to the product.
- E. The geotextile shall have been inspected continuously during manufacture for the presence of broken needles using an in-line metal detector system. Any needles detected in the material shall be removed.

#### 2.02 SOURCE QUALITY CONTROL

- A. The geotextile manufacturer shall furnish materials whose "Minimum Average Roll Values" (MARV) as defined by the Federal Highway Administration (FHWA) meet or exceed geotextile property values specified in the following table:

<u>Property</u>	<u>Test Method</u>	<u>Standard</u>
Thickness, mm (mil)	ASTM D-5199	4.69 (185)
Unit Weight, g/m <sup>2</sup> (oz/sy)	ASTM D-5261	416 (16)
Grab Strength, N (lb)	ASTM D-4632	2223 (500)
Grab Elongation, %	ASTM D-4632	70
Trapezoidal Tear, N (lb)	ASTM D-4533	668 (150)

Puncture Resistance, N (lb)	ASTM D-4833	867 (195)
Hydraulic Bursting Strength, kPa, (psi)	ASTM D-3786	5377 (780)
Water Permeability, cm/sec	ASTM D-4491	0.25
Transmissivity, m <sup>2</sup> /s	ASTM D-4716	0.001
Apparent Opening Size, mm (U.S. Sieve Size)	ASTM D-4751	0.149 to 0.125 (100 to 120)
UV Resistance, %	ASTM D-4355	70

- B. Geotextiles shall be tested by the geotextile manufacturer to evaluate characteristics for quality control. Samples not satisfying specifications in the table above or manufacturers specifications shall result in rejection of applicable rolls.
- C. Quality control tests shall be performed for every 10,000 square meters (100,000 square feet) or more frequently. Additional testing may be performed at manufacturer's expense to more closely identify non-complying rolls and to qualify individual rolls.

### PART 3 - EXECUTION

#### 3.01 PREPARATION

- A. The geotextile shall not be deployed until subgrade grades and elevations are correct.
- B. The surface to receive geotextile shall be smooth and free of litter, sharp protrusions, and large stones. The installer shall insure that the subgrade does not contain unsuitable, unstable, or soft material. The subgrade shall be free of mud or soft soil materials that would choke fabric openings.

#### 3.02 INSTALLATION

- A. Prevent damage to underlying layers during deployment of geotextile.
- B. During geotextile deployment, do not entrap stones, excessive dust, or moisture in or beneath geotextile that could damage the material, cause clogging of drains, filters, or hamper subsequent seaming.
- C. Overlapped seams shall have a minimum overlap of 8 centimeters (4 inches).
- D. Deployed panels of geotextile shall be weighted with sandbags or equivalent. Sandbags shall be used during deployment and shall remain until replaced with cover material.
- E. Geotextiles shall not be exposed to precipitation prior to deployment.

### 3.03 SEAMING

- A. Seaming shall be by sewing. All seams shall be continuously seamed. Spot seaming will not be accepted.
- B. Sewing shall be performed using polymeric thread with chemical properties equal to or exceeding those of the geotextile. A locking stitch shall be used.

### 3.04 REPAIRING

- A. Damaged areas shall be repaired with a patch that extends at least 0.3 meter (1 foot) beyond the perimeter of the tear or damage. The patch shall be seamed in accordance with Paragraph 3.03 of this Section.
- B. Care shall be taken to remove any soil or other material which may have penetrated through the torn geotextile.

END SECTION 02282  
GEOTEXTILE